POPULAR MECHANICS

do-it-yourself ENCYCLOPEDIA

Photo courtesy National Gypsum

CEILING TILE not only sets off a room, but can act as a sound barrier, too. Best of all, anyone can apply it. For specific instructions, see page 573

Photos courtesy Grumman Canoes

A BIG BOOM in canoeing is sweeping the country. No type of boating is as inexpensive or more fun. You can use a canoe to learn the rudiments of sailing (right) or just for lazying down the river (far right). For tips on choosing the right canoe, see page 465

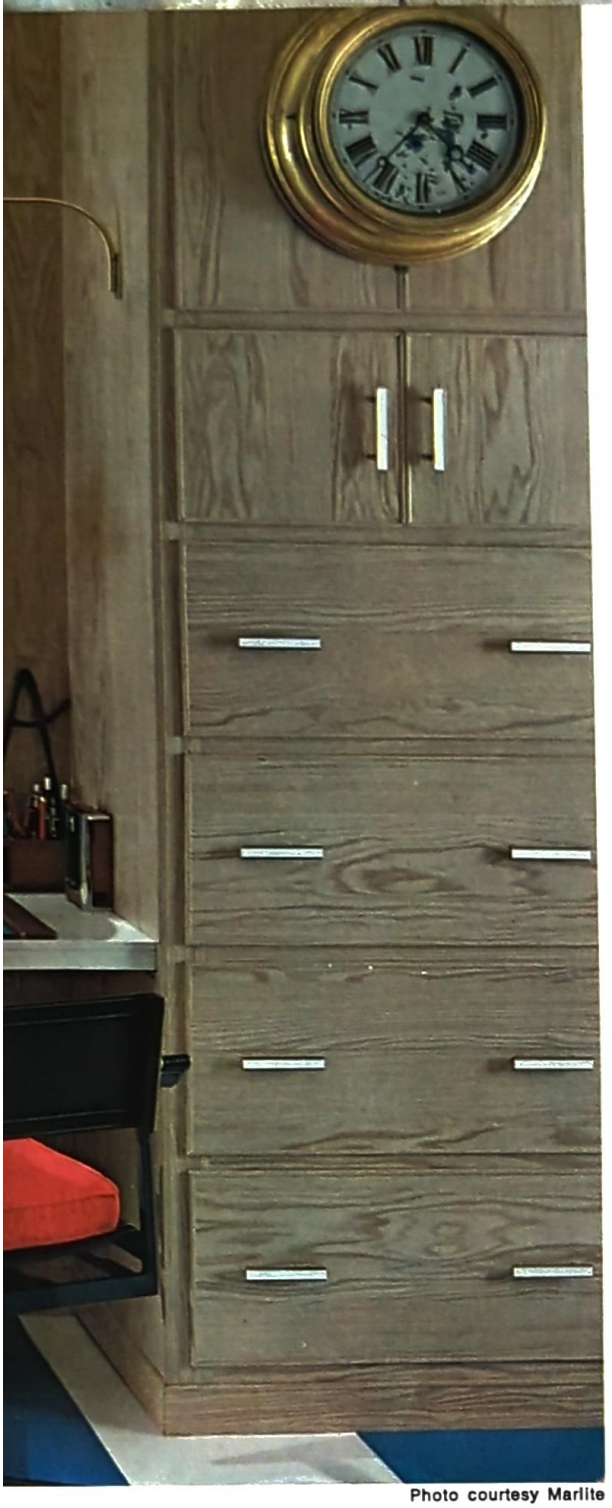


Photo courtesy Marlite

Photo courtesy Sherwin-Williams

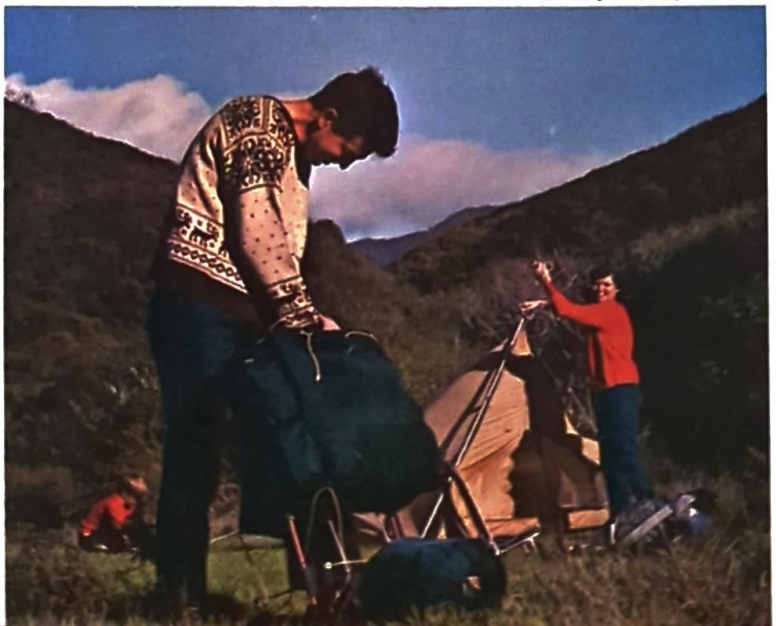
THE RIGHT BRUSH is the secret of any finishing job, whether you're painting the mantel or refinishing an antique. Learn how to select a good one on page 395

BUILT-INS ARE BONUSES in any home, but before you start such a project you must know techniques of framing and other building basics. Study the methods of experienced builders on page 400

Photo courtesy Johnson Motors

IF YOU ENJOY camping, you'll find a wealth of tips to help keep you comfortable in the article on page 434. And why not try boat camping (above)? It can take you to otherwise inaccessible spots. For other suggestions on camping, see pages 438–446

Photo courtesy Himalayan Packs



Popular Mechanics Do-It-Yourself Encyclopedia

in 16 volumes

A complete guide to

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- home improvement
- hand-tool skills
- craft projects
- power-tool know-how
- hobbies
- automotive upkeep
- automotive repair
- shop shortcuts
- boating
- fishing
- hunting
- model making
- outdoor living
- radio, TV and electronics

Volume 3

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VOLUME 3

brickwork
Cookout bar and planter 389

brushes, paint
What you should know about paint brushes 395

building
Building basics every man should know 400
Tips from builders 406

cabanas
Poolside cabanas 408
Tuckaway camper cabana 412

cabinets
High-style cabinet 414

cabinets, speaker
Interflex—a new speaker system 418
Better sound from any speaker 423
Big bass, small speaker 424

cam-dwell meter
Cam-dwell meter for auto tuneups 426

cameras, used
How to buy a good used camera 430

camping
Snug camping in foul weather 434
Kinks for campers 438
Work-savers for campers 439
Pamper your camp gear 443

candle holders
Candle cups 448

candles
Handsome gift candles 449
Danish candle 452

candlesticks
Double-spiral candlestick 454

caning
New seat for a chair 458

cannon, toy
Your kids will get a bang out of this 462

canoes
Which canoe is best for you? 463

car, downhill racer
Build this "Grand Prix" coaster 466

carburetor, auto
The ABCs of carburetion 468
Should you lay a hand on your carburetor? 473

carburetors, outboard
Troubleshooting outboard carburetors 484

carpenter ants
Rid your house of carpenter ants 489

cars, midget
Chassis for a Suburba-car 492

cars, sidewalk
Build your kids the Sidewalk Classic 501
Build an electric Scoot-car 513

car-top carriers
Load carriers for Volkswagens 522

car-top sleepers
Upper berth for a station wagon 526

carts
Seven variations on a basic cart 532
Party cart 540

carving
Decorative carving with a circle cutter 544

car wash
Build a five-minute car wash 547

catamaran, sailing
Build a sailing cat 550

caulking
A master guide to caulking 562

ceilings
What you should know about ceiling tile 573

How to use your Encyclopedia

Browse. Glance through this volume, or any other volume of the Encyclopedia. Likely you will find the solution to a particular home-maintenance problem that has been bothering you, or a shop project so appealing that you will immediately head for your bench. Browsing not only is enjoyable, but is a source of ideas.

Seek specific information. Perhaps you want to find out how to cure that leak in your basement, how to keep the exterior paint from peeling, or how to tune and set the carburetor on your car.

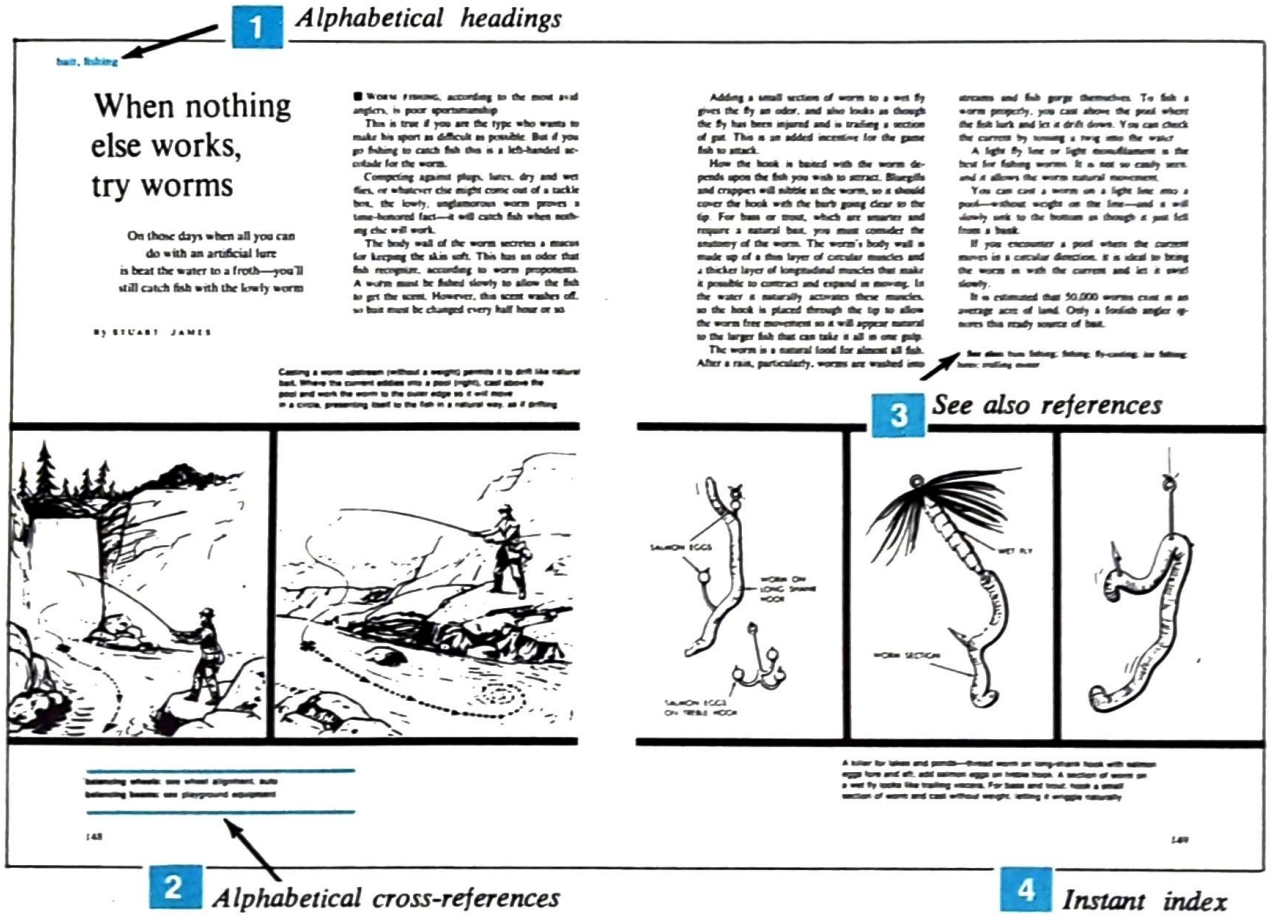
Four reader aids, all cross-referenced, will enable you to find specific information:

1. *Alphabetical headings.* Located at the top of the page, these headings cover broad classifications of information. If you are looking for information on how to keep paint from peeling, for example, look up "Paints" alphabetically, then find the particular section dealing with peeling paint.

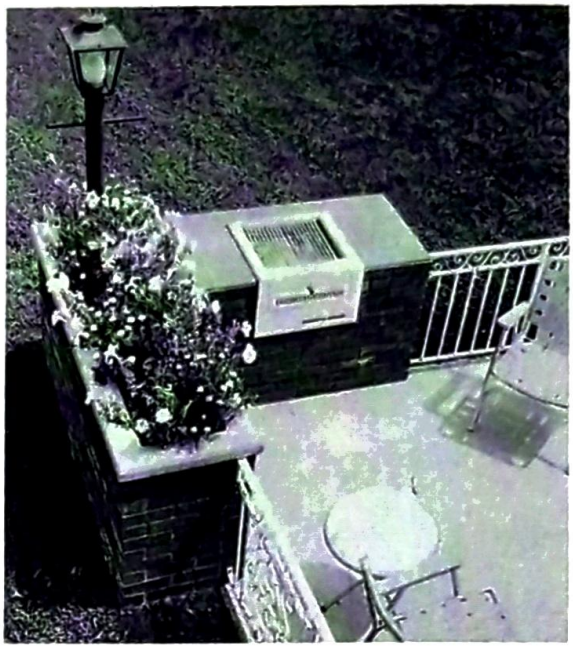
2. *Alphabetical cross-references.* These are shown in a box at the bottom of the page. Some material can logically be classified under more than one alphabetical heading, so if you don't find what you are seeking alphabetically (as described above), be sure to check the *alphabetical cross-references* at the bottom of the page; there you may find precisely the classification you are seeking. For example, you and your son decide to build a model airplane, and are looking for plans. You look up "Model airplanes" and find nothing under that alphabetical heading. However, if you glance at the bottom *of that same page* you will find an alphabetical cross-reference that reads: **model airplanes,** see airplane models.

3. *See also references.* These are shown at the end of many articles. They refer you to related articles which may also be of interest.

4. *Instant index.* Located at the end of Volume 16, it is thoroughly cross-referenced to help you find information under any heading.


1 Alphabetical headings
bait, fishing
When nothing else works, try worms
On those days when all you can do with an artificial lure is beat the water to a froth—you'll still catch fish with the lowly worm
BY STUART JAMES
3 See also references
2 Alphabetical cross-references
4 Instant index

This built-in barbecue grill and its illuminated planter make cookouts fun



Cookout bar and planter

BY WAYNE C. LECKEY

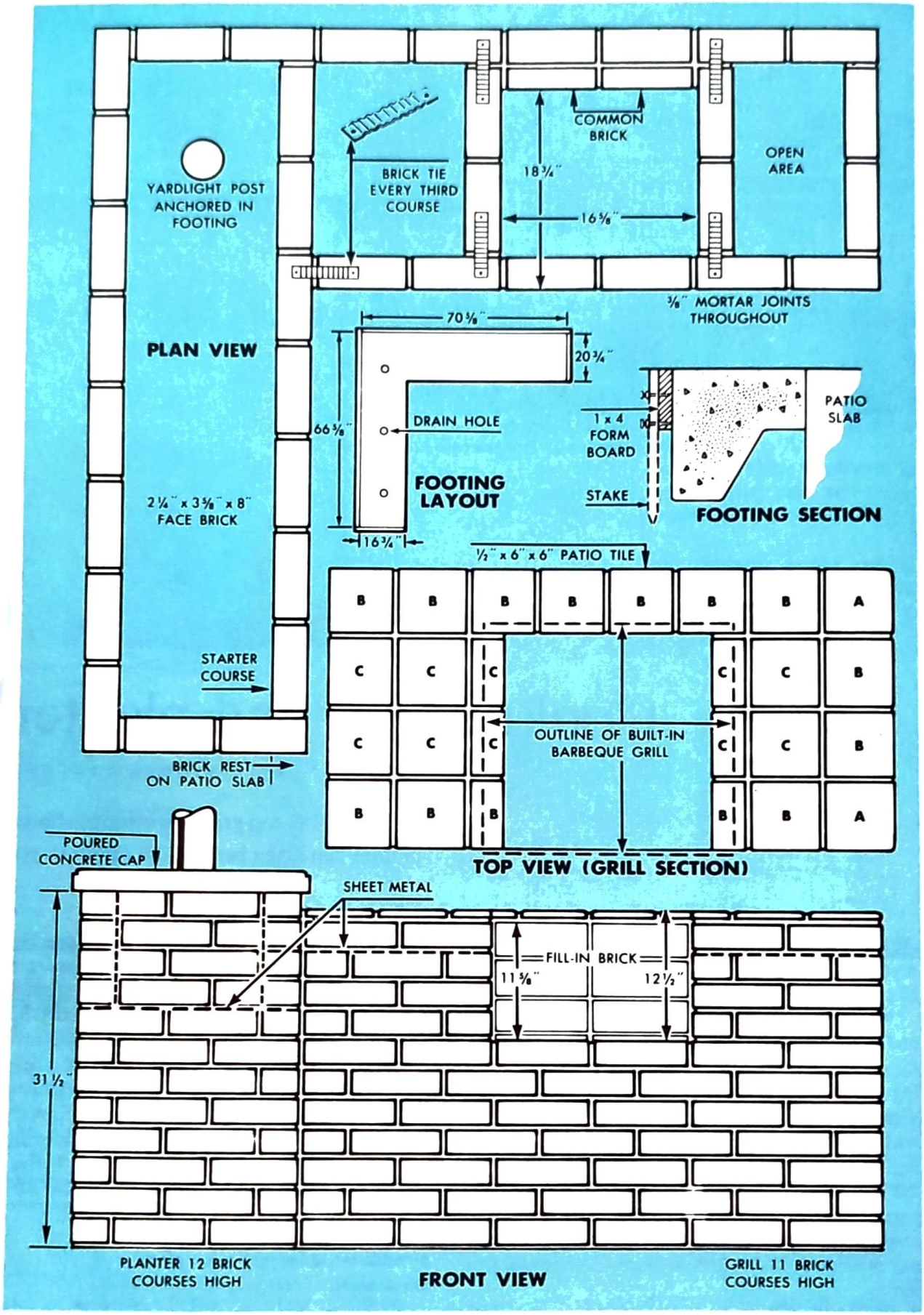
This table-top grill in a brick barbecue planter can bring beauty and utility to your patio

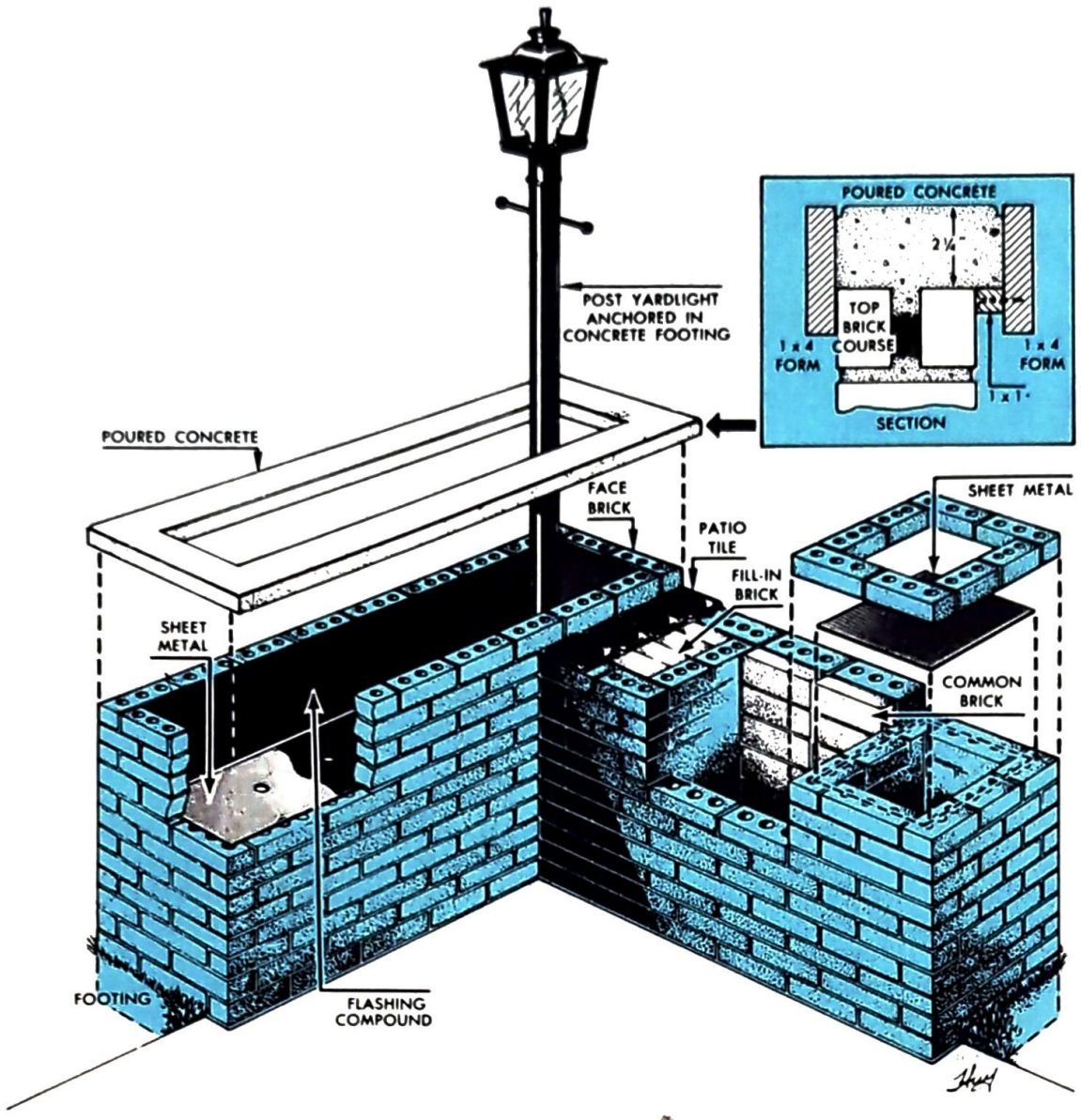
LIKE SO MANY PATIOS, ours was nothing but a concrete slab. Unattractive, uninviting, it was like sitting out in left field.

We had it poured when the house was built and couldn't wait to do something with it. We liked the idea of a planter to add a touch of living color. We liked the idea of a table-top grill with counter space alongside to set things. And we liked that fenced-in feeling you get with a railing. We wanted a post lantern which would make the planter come alive with light and become a part of after-dark cookouts. The photos you see above show how our ideas came to life and how our plain patio slab blossomed into a showplace setting.

- The built-in charcoal unit we used is one of several on the market. We selected this one because it had a flange on three sides to rest in a well and could be lifted out for winter storage. The dimensions given are for this particular unit. To protect it from rain, we keep the grill covered between cookouts with a piece of sheet plastic, hemmed along two edges for weighting with curtain rods. I tiled the counter top with regular hearth tile and applied a liquid dressing to protect it.
- Although I had never laid brick, I was sur-

British thermal unit: see air conditioners
broadcaster, guitar: see guitar amplifier
broadcaster, voices: see electronics


YARDLIGHT POST ANCHORED IN FOOTING
BRICK TIE EVERY THIRD COURSE
COMMON BRICK
18¾"
16⅝"
OPEN AREA
⅜" MORTAR JOINTS THROUGHOUT
PLAN VIEW
70⅝"
20¾"
66⅝"
DRAIN HOLE
FOOTING LAYOUT
1 x 4 FORM BOARD
STAKE
PATIO SLAB
FOOTING SECTION
2¼" x 3⅝" x 8" FACE BRICK
16¾"
½" x 6" x 6" PATIO TILE
STARTER COURSE
BRICK REST ON PATIO SLAB
OUTLINE OF BUILT-IN BARBEQUE GRILL
TOP VIEW (GRILL SECTION)
POURED CONCRETE CAP
SHEET METAL
FILL-IN BRICK
11⅝"
12½"
31½"
PLANTER 12 BRICK COURSES HIGH
FRONT VIEW
GRILL 11 BRICK COURSES HIGH

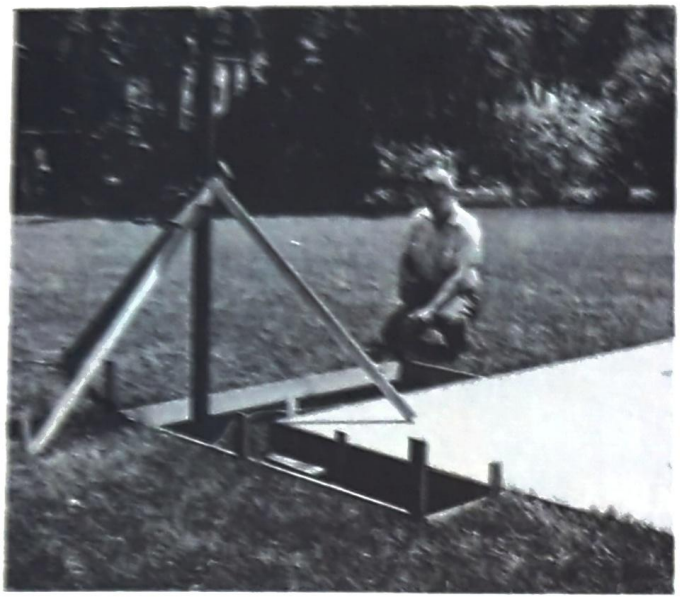


prised to find it wasn't the skilled job I anticipated. As long as I kept the corners plumb, the rest was a case of keeping the courses running straight and level, much as you would in stacking a set of building blocks. My yardcart made a dandy little box-on-wheels for mixing the mortar, and the four bricklaying tools I had to buy were just a trowel, a level, a joint raker and a ball of string.

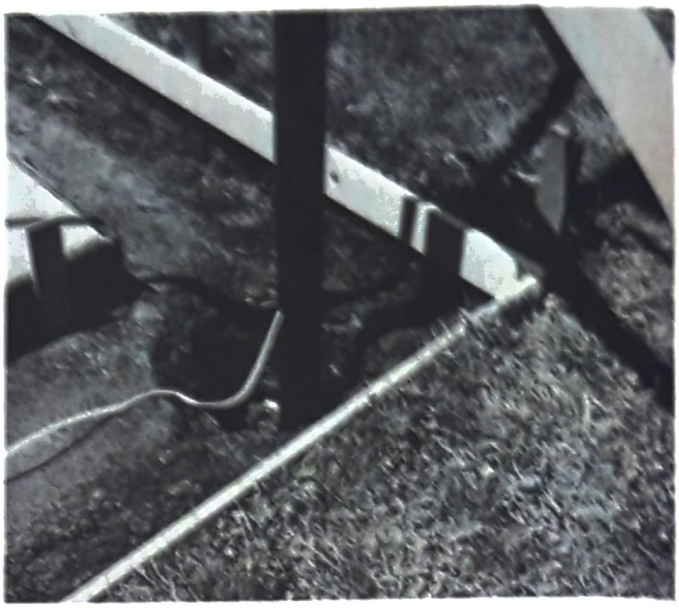
• My first job was to provide a concrete base at one corner of the patio slab, and from the sequence photos on the next page, you can see how I first had to dig an L-shape hole about 18 in. deep and line it with a 1 x 4 form set level with the top of the slab. The post lantern had to be set in position at this time too since it was to be anchored in the footing. After running plastic-covered cable from a switch in the house to the lantern and then burying it below ground, I plumbed the post and then braced it to hold it so. With the braces nailed to stakes, I used a couple of C-clamps to clamp the braces to the post.

• It was convenient for me to order ready-mix concrete and it saved me the job and mess of mixing it myself. However, you could make use of packaged dry mix. It took ½ yd. of concrete to fill the form, and since it serves as only a footing, I merely struck it off with a board flush with the form and patio slab. The overall size of the footing given in the blueprint is based on the use of 8-in. bricks with ⅜-in. mortar joints.

• In studying the blueprint, you'll note that the planter is made one course higher than the grill section. Also that a sheet-metal bottom is placed in the planter when you reach the 8th course and that the grill well is left open at the front after you reach the 7th course. A total of 418 face brick is required, plus 28 common brick. The latter are used as fill brick directly under the



My first step was to dig for the footing and then to make a form level with the patio slab by staking form boards in place. The post lantern will be anchored in the footing and is kept plumb by braces until concrete sets

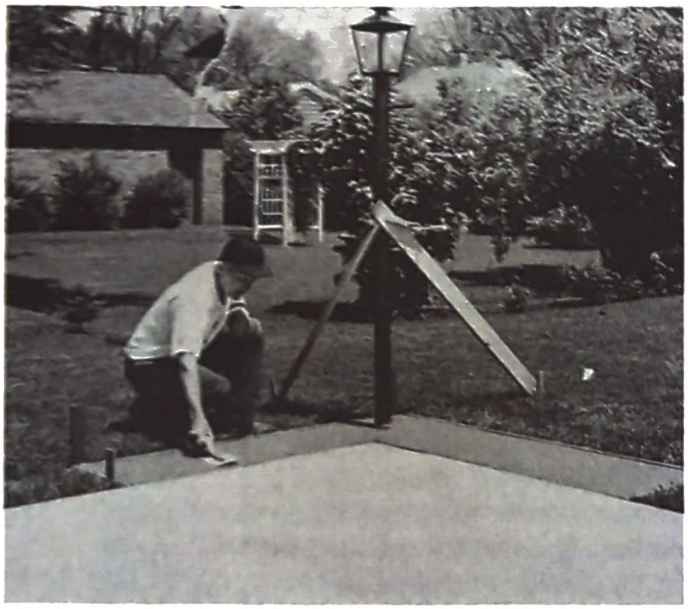


The post lantern is set in a hole dug inside of the footing excavation. Heavy plastic-covered wire is buried in the footing and runs underground to a switch located at the rear entrance of the house

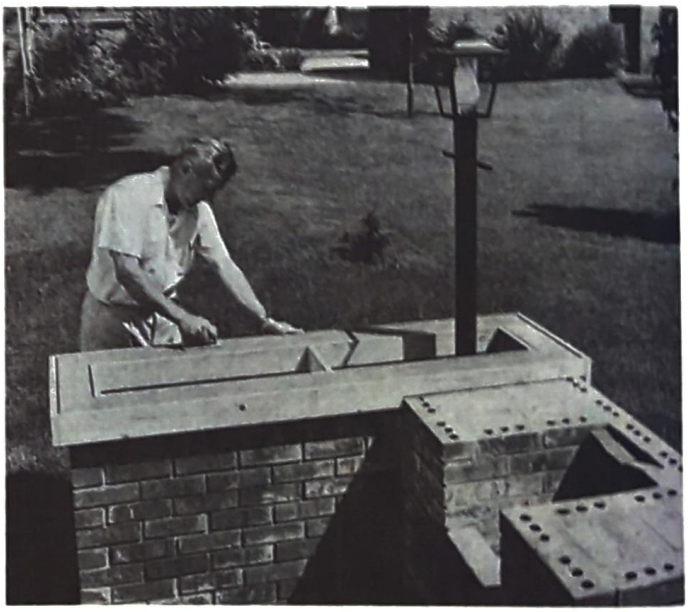
tile counter top and at the rear of the well. Five of the face brick will have to be cut. The plan view shows the order in which the bricks of the starter course are placed on the footing. The pattern as given repeats every other course. At points where the brick courses merely butt, rather than interlap, I used brick ties. These are corrugated strips of sheet metal which are embedded in the mortar of every other course as you go along. Your brick dealer has them.

I used bagged mortar mix to which you merely add water. It took approximately five sacks.

cookout bar and planter, continued



The form has been filled with concrete and is being finished off. This form called for about half a yard of ready-mix, but the amount will vary with the depth of the footing. Make sure the post is plumb

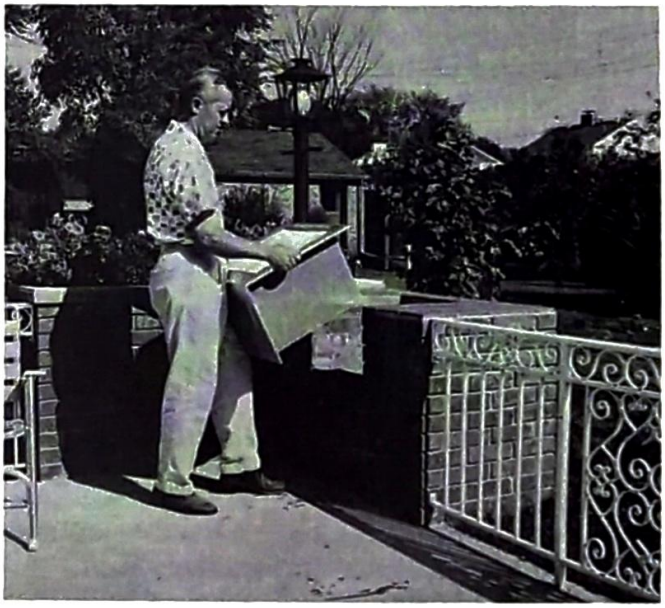


The cap has been poured into a form built around the top of the planter. The mixture should be on the soupy side and spaded thoroughly with a stick before finishing so that there won't be any voids in the edges

The top of the grill section is finished with hearth tile. Constant checking with a level throughout this job pays off in producing a flat counter top. At the right, a star drill is used to make holes in the brick. These holes are for lead anchors which will be used to attach the wrought-iron railing

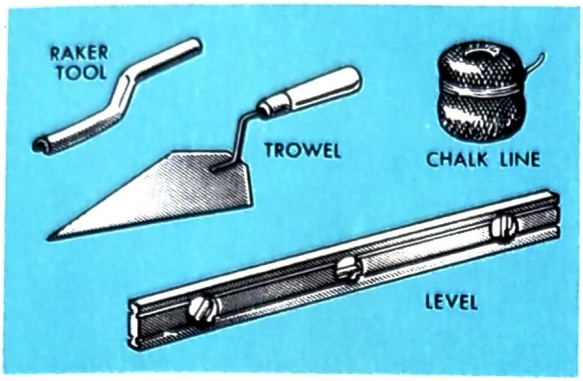
Don't mix it too soupy or it won't cling in buttering the bricks. Buttering is a term used when the mortar is applied to the ends of the bricks in cementing them end to end.

- Make a dry run of your first course, placing the 37 bricks in the order given, ⅜ in. apart and without mortar. This will give you an idea how evenly they space out on the footing. Note that the bricks rest on the edge of the existing patio slab. This is necessary so you later can attach the wrought-iron railing. Always keep the bricks you are working with dampened. Dry bricks will



After completing the laying of the hearth tile, the top is cleaned with an acid bath to remove mortar smudges. Use rubber gloves to protect your hands for this job. Do this a day after the tile has been set but before the mortar gets too hard. Rinse the acid away with a hose. Finally, set the grill in place

BRICK LAYING TOOLS NEEDED



Aside from ordinary tools, such as a hammer, saw, etc., here are the four basic tools you'll need to lay your bricks. You can make your own raker tool by notching the end of a flat steel bar

cookout bar and planter, continued

draw the water out of the mortar too fast.

Now to actually lay the bricks: Start with the planter section and place a trowel of mortar on the footing where the first brick will rest. Tap it down with the trowel handle until you have a ⅜-in. layer of mortar under it. Place a level on this corner brick to check it. Proceed with the second brick the same way, spreading a layer of mortar for it as before. Grab the brick with the left hand and butter the end with mortar. Then set it in place, tapping it down gently and easing it against the first brick until you have a ⅜-in. joint between. Excess mortar which oozes out is scraped off flush with an upward swing of the trowel.

- While the same number of bricks is used in the second course, placement shifts ½ brick, so to speak, so that the new vertical joints will straddle those of the course below. Procedure varies also in that the five outside corners are built up like steps two or three courses ahead of the rest. Here it is important that you check them for plumb, both directions. If you keep the corners rising plumb, you can't go wrong with the rest. In filling-in each course between the corner bricks, you now lay your bricks to a string (chalk line) stretched taut and aligned with the very outer edge. This is done by weighting the string with a brick at each end.
- Raked mortar joints give your work a professional look and you should stop to do this after about every third course. Raking is done with a special tool which is used to rake or scrape the mortar from the joints to a depth of about ¼ in. before the mortar hardens.
- The sheet-metal (18 ga.) bottoms which block off the two open end wells in the grill section, as well as form a bottom for the planter, are cut to lap the brick about half their width. The metal is embedded in a layer of mortar as you proceed. In the case of the planter, drain holes are made in the metal bottom beforehand, as well as a hole to slip it down over the lantern post. Once the top course of the grill section is reached, the blocked-off wells are filled with a layer of common bricks, mortared in place, flush with the rest. Since two full bricks make the depth of the grill well too deep, a lining of common bricks, placed on edge, is mortared against the back wall of the well.

lay hearth tile next

Hearth tile, ½ in. thick and 6 in. square, comes with two edges rounded (A in the blueprint) one edge rounded (B), and plain (C). Each is priced according to shape, the plain being cheapest, and the blueprint shows you how many of each it takes to tile the top of the grill counter. These are laid in mortar, the joints being struck (troweled) concave with any suitable object. Only the tile along the two sides of the well require cutting. The rest space out perfectly.

- I made a simple wood form for the cap around the top of the planter and cast the cap in place. The inner form was simply wedged in position and the outer one clamped to it. The clamps were left in place while the cap was poured. I greased the wood so the form would pull off easily. Here your concrete mix should be made somewhat soupy and spaded good as it is put in the form so you won't have any air pockets (voids) in it when you remove the form. The holes in the brick give good anchorage to the poured cap.
- As final steps, I troweled a heavy coat of flashing compound on the inside of the planter, being careful not to block the drain holes in the bottom. Then, wearing rubber gloves, I washed the outer face of the brickwork by scrubbing it with a fiber brush dipped in a diluted solution of muriatic acid (10 parts water and 1 part acid) and hosed it off with water. The acid removes all the mortar smudges from the face of the brick, as well as the tile.
- The wrought-iron railing is a stock pattern ordered to fit. Here, again, there are any number of makers of similar railing.

See also: concrete; fences; home improvement; planters; retaining walls; walls.

Select a paint brush as you would a tool—each has its points that determine quality and performance

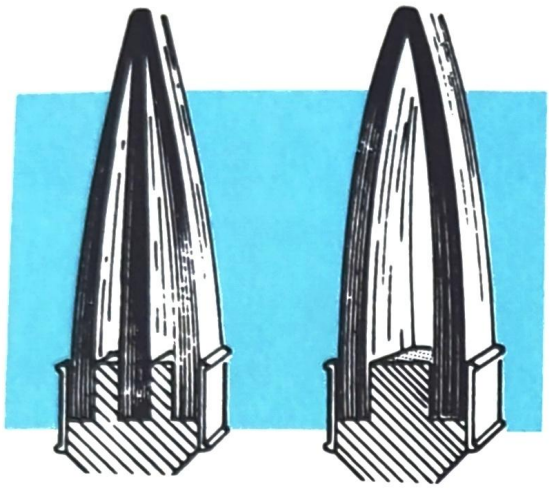
What you should know about paint brushes

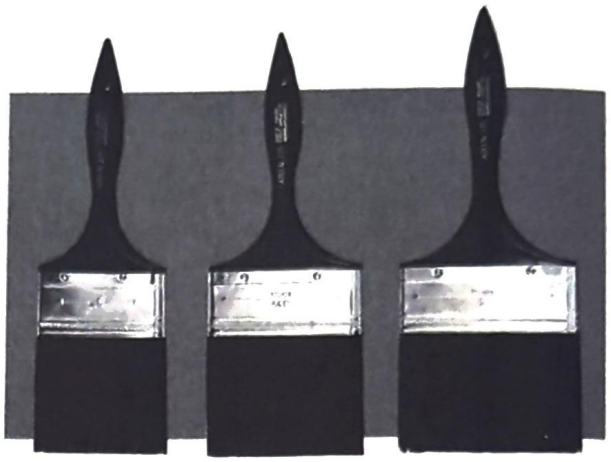
BY W. CLYDE LAMMEY

PAINT-BRUSH QUALITY and spreadability are largely determined by the number and length of the bristles. When dipped about ⅓ the length of the bristles in pigmented finishing materials such as paints and enamels, a quality brush will pick up just the right amount and lay it on a vertical or horizontal surface in a smooth film of uniform thickness without sags, runs, drips, or brush marks.

Pro painters, decorators and restorers are sticklers for quality and they generally pick a brush by points, keeping always in mind the purpose for which it is to be used. A painter will want a brush with plenty of "body" and fairly long bristles that will pick up and carry a good load of paint at each dip and hold it to a uniform film thickness throughout a long, sweeping stroke. Decorators who prefer a brush to roller application will look for much the same characteristics in the brush they use to apply oil-base or water-soluble paints or enamels to interior walls and woodwork.

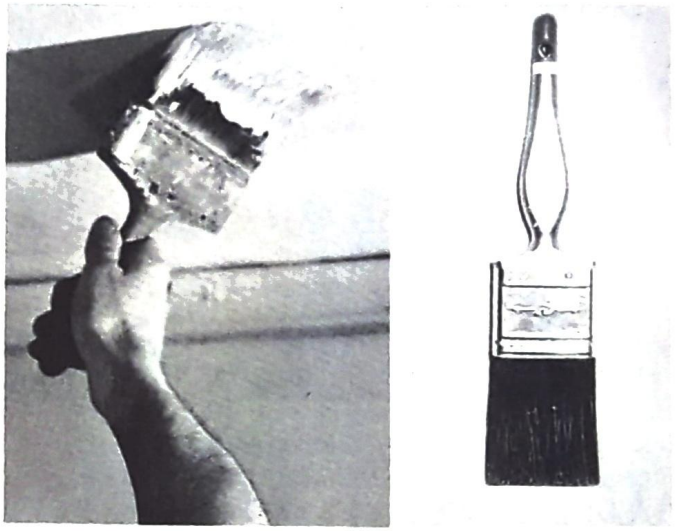
Such brushes usually come with natural (animal) bristles or with bristles made from synthetic





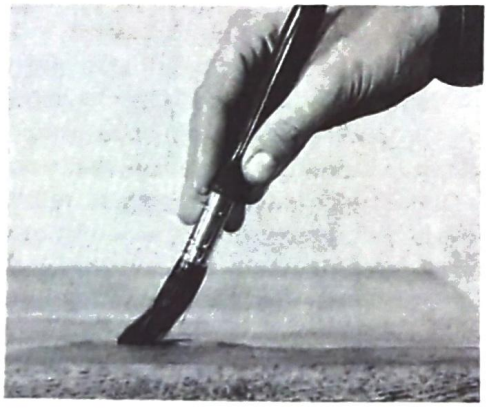
At the left you see the difference between two and three rows of bristles in paint brushes. High-quality brushes are usually made with three rows of bristles in the filler block which is a part of the handle. Right, a few of the many widths of brushes which are available

On vertical surfaces you flow the material on smoothly with a fairly fast sweep of the brush, using a light but uniform pressure

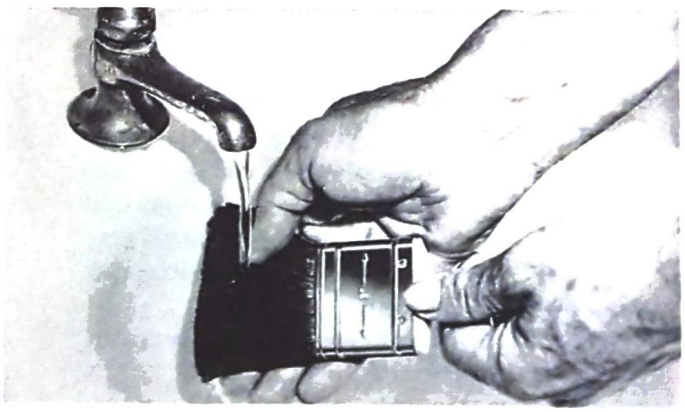


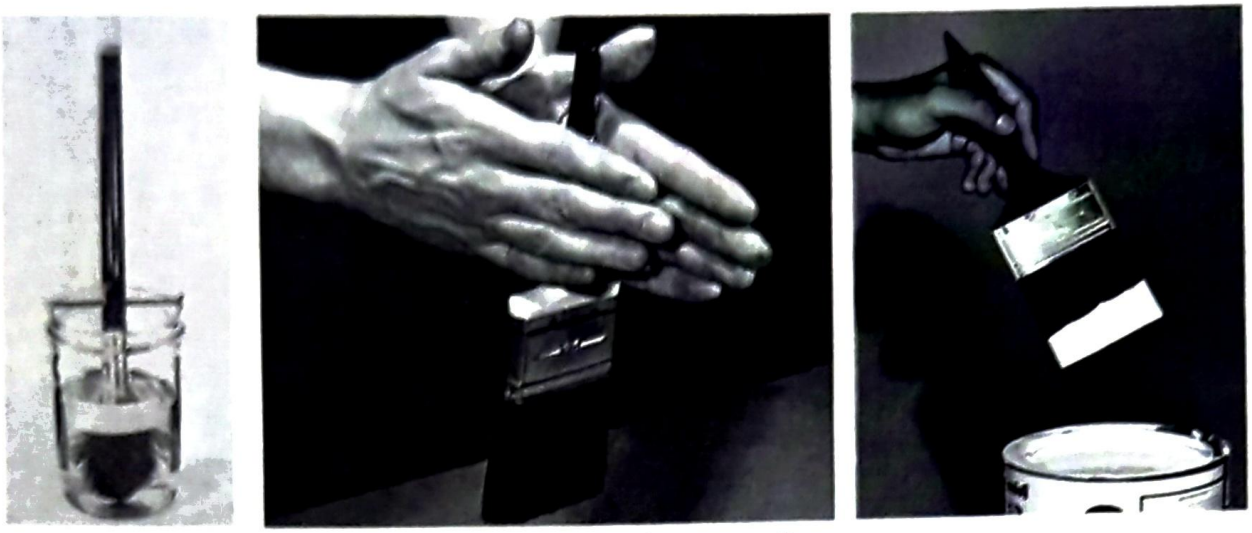
Left, pressure on the brush largely determines the amount of material laid on a surface. Right, bristles of this brush are cut wedge-shape, forming a "chisel edge"

Always brush off an edge, as otherwise you'll have trouble with drips. It helps to give the brush a slight twist at an edge



Brushes used in water-soluble materials are easily cleaned in tap water. Work the bristles gently with thumb and fingers to make sure all finishing materials have been washed away





Above are two steps you should take to condition a brush before you use it. First, suspend it in linseed oil for 24 to 36 hrs. Then remove excess oil by twirling the handle between the palms. Wash in solvent

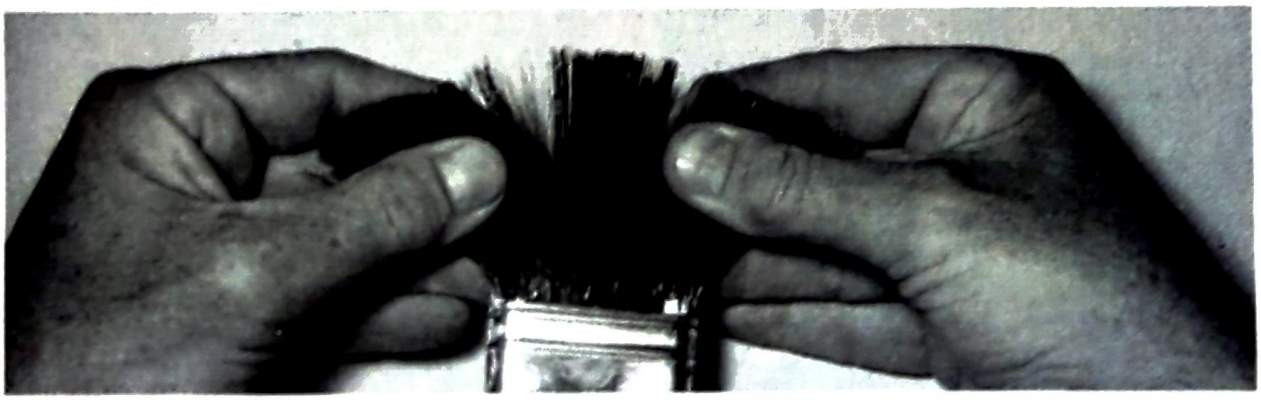
materials such as nylon. Bristles of the best brushes of either type have "flagged" ends, or tips, the term referring to the outer ends of the bristles which are "split," or divided, to form a number of hair-like projections. On the animal bristle these are a natural characteristic of those selected for the manufacture of brushes. On the synthetic bristles, such as those made from nylon, the flags are produced artificially.

For application of the free-flowing, quick-drying finishes and stains used by the home craftsman, refinisher and restorer, a softer brush with a little less "spring" usually is best. Quality brushes for this work are made with soft, flexible bristles selected from the pelts of such animals as the goat, sable, badger and others. These brushes, in the top grades, usually are full-bodied and the bristles are trimmed to a wedge shape, forming what is commonly referred to as a chisel edge. This shape of the edge makes it possible to lay, or "cut," a sharply defined line of finishing material with the corner, or edge, of the brush without forming a bead. The chisel edge also enables the user to spread a uniform film of finishing material without brushing out or working back over the material laid on in a one-direction brush stroke.

One quick check to determine quality in a brush is to spread the bristles with the thumbs and forefingers as pictured below. This will determine the body, or density, of the bristles and whether they are inserted in the filler block—a part of the handle—in two or three rows. Once parted, the bristles should spring back into position when released. There should be a minimum of loose bristles in a new brush, although a few loose bristles are not necessarily an indication of poor quality. As a rule the best brushes have three rows of bristles in the filler block.

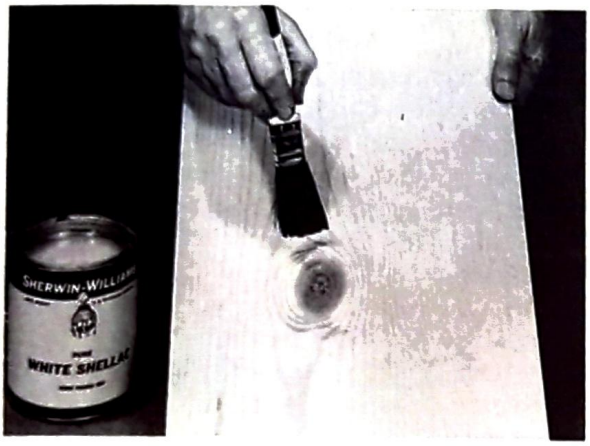
In your paint dealer's brush racks you'll see

Here's a quick check of brush quality. Bristles should be full-bodied, resilient; should spring back when released

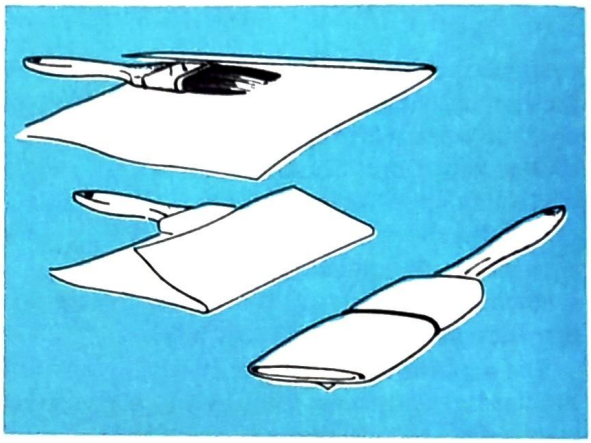


brushes, continued

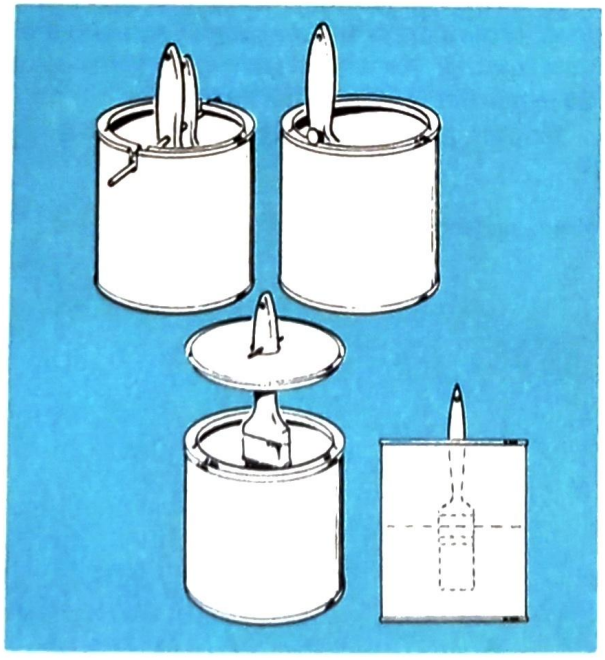
Left, a strike wire on the container is always handy. Right, brush always from wet to dry



Seal a knot with shellac after finish-sanding the wood, and be sure to clean the brush with alcohol immediately after use



Many finishing materials will harden in bristles in an hour or less. If you must leave a job unfinished, wrap the brush tightly in aluminum foil



Brushes can be stored safely for a limited time in a keeper you can easily make yourself from a 1-gal. can with a friction lid. Fill the can with sufficient linseed oil to fully cover the bristles. Add a little pure turpentine and cover with plastic wrapping or aluminum foil

brushes for just about every purpose, in varying widths and lengths of bristle and in quality ranging from the cheap, use-once-and-throw-away brush, usually in a narrow width, to the top-quality product with long, springy bristles having flagged ends.

Perhaps the most commonly used widths range from 1 to 4 in., with the "specials" running both narrower and wider. For painting exterior siding the 4-in. brush is probably the most commonly used with a 1-in. brush at hand for painting sash and other more intricate work. For laying on

Top, left, when applying a penetrating stain the strokes must overlap slightly to avoid "holidays" and skips. Top, right, don't ever do this with a good brush; it ruins it for further use. Always use a narrower brush. Above, avoid "joining" strokes whenever possible. Strokes should be continuous

stains, sealers, shellacs, varnishes, lacquers and other synthetics most finishers will select a 1½ to 2-in. brush for large surfaces and a 1-in., or even a ½-in. brush, for the fine detail work. The widths are only suggestive, not arbitrary. The large, wide brush will carry more finishing material and cover a larger area with a minimum of brushing, either when applying paints and enamels or laying on clear finishing materials. But the large, wide brush can't be used to advantage for painting, or "cutting in," sash or

Clean bristles occasionally with wire brush and a brush comb to remove any paint residues

Left, using the side of the brush on a narrow surface causes the bristles to "finger." There's no practical cure. Right, as the final step in cleaning, work solvent into the heel of the brush with the fingers

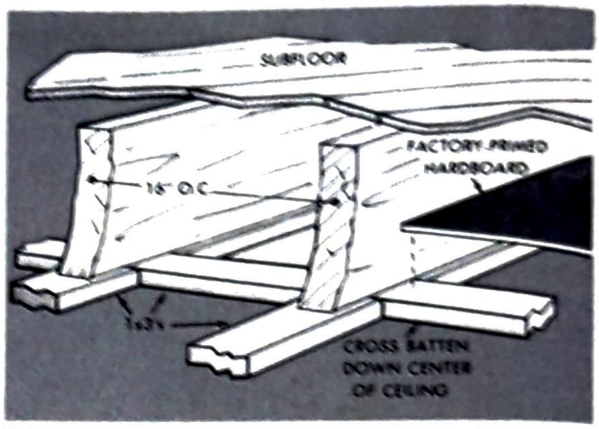
handling other close detail work. Much the same rule of thumb applies to interior decorating with paint and the brush-application of clear finishing materials.

New brushes should be conditioned before use, as otherwise the individual bristles will absorb finishing materials and stiffen. This lessens normal resiliency and spreadability. It is the common practice to suspend the brush (if necessary drill a small hole through the handle to take a wire support) in a can or brush-keeper containing sufficient linseed oil (boiled) to cover the bristles when the brush is supported in the can. Allow the bristles to remain in the oil for 24 to 36 hrs. Then hold the brush inside the can or other container and twirl the handle between the palms to remove excess oil. Dip in turpentine and continue to twirl in this manner until all oil has been removed.

Don't permit finishing materials or paint to harden *in* the brush. If you must leave a job unfinished and you are using a finish that hardens within an hour, then clean the brush thoroughly in a solvent sometime within that hour. There are special solvents for reclaiming brushes in which finishes or paints have hardened, but avoid their use whenever possible by cleaning the brush promptly. Use the correct solvent: lacquer reducer (thinner) for brushes used in lacquers; turpentine or synthetic solvents for the common clear finishes and paints; and alcohol for brushes used to apply shellac.

To store brushes for long periods of time do a thorough job of cleaning in solvent, running a brush comb through the bristles to straighten them. Then wrap in oiled paper, the wrapping so made that it excludes air and extends up onto the handle where it can be sealed with tape.

Batten and loose-hardboard-panel ceiling



This is one way to cover exposed basement joists. It permits easy access to pipes and wiring

Building basics every man should know

WHEN A REMODELING JOB calls for framing —or even simple furring to install ceiling or wall panels—many homeowners feel out of their depth and turn to professional help. Yet few building techniques are so simple and standardized. Most framing—for erecting partition walls, enclosing understairs space or creating built-in cabinets, for example—is done with the familiar 2 x 4. Unless you're boxing in a duct or other obstruction, as at the base of the wall shown here, partition framing involves only a sole plate spiked to the floor, a top plate fastened to the ceiling (or joists) and studs toenailed between—usually 16 inches on center. The only trick is to keep the studs exactly vertical and parallel, and this can be accomplished with a level or plumb line. This is especially important when the partition is to be faced with standard 16-in.-wide panels, as at left, since the panels are centered on the studs.

The principal thing to remember when framing door or window openings—or when enlarging existing ones (page 403)—is that you've cut away studs that normally help carry the wall load. The purpose of the horizontal member (header) at the top of the opening is to redistribute the load toward each side, where the header is supported by a trimmer—the inner half of a doubled stud. The width of the header depends on the opening it must span. A doubled 2 x 4 is heavy enough for a 4-ft. opening; a doubled 2 x 6 for a 6-ft. opening; and a doubled 2 x 8 for up to an

No-furring, no stapling acoustical ceiling

A heavy-bodied adhesive, in dabs the size of walnuts, is placed at the corners of the tile on spots which have already been primed with adhesive. Give adhesive several days to set

Starting from a corner of the ceiling, each tile is placed ½ in. from its final position and pressed to within ⅛ in. of the ceiling. Then tile is slid to join adjacent tiles.

Big wallboard panels cover joists fast and can be handled by one man with the aid of a T-brace made from 2 x 2s. The long edges of the board should be centered on a stud

8-ft. span. Built-up headers are always set on edge and spaced apart with lath shims to match the stud width.

In framing basement or attic partitions, the low ceiling often makes a dropped header unnecessary. In these cases, the trimmers continue up to the top plate. Door trimmers usually run down to the floor, inside the gap in the sole plate.

Furring strips, like studs, are commonly spaced 16 in. on center, but may be applied vertically or horizontally, depending on the type of finish wall they are to receive. Furring is most often 1 x 2 softwood strips, though 1 x 3s are also used.

An unusual example of ceiling furring is the batten application, above left. One batten is nailed at right angles to the joists (or rafters) at their center point, and runs the full length of the room. Short battens, fastened to the bottom edge of each joist, form lips on which the cut-to-size hardboard panels rest. Batt or blanket insulation could be stapled between the joists before the panels are tipped into place.

There's a commercial system that works on a similar suspended-panel principle, but involves a "floating" aluminum grid on wire hangers. Though it isn't intended for areas of low headroom, it's ideal where a lowered ceiling is desired, or for concealing exposed pipes or cracked plaster. A choice of slip-in panels is available—either acoustical or translucent.

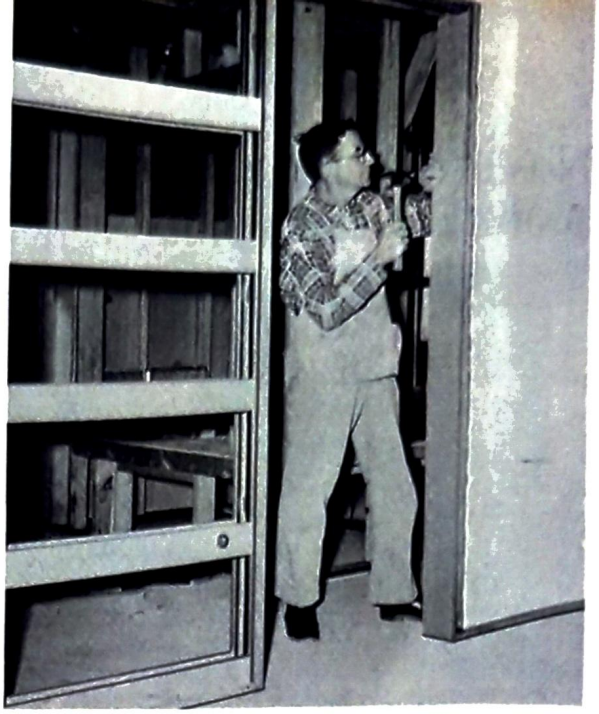
Another novel ceiling treatment, shown at left, avoids furring and grids altogether. The wallboard layer also increases the ceiling's sound-deadening properties. After applying the tile, as shown, put off installation of any cove molding for several days to give the adhesive time to set. And remember it's easier to paint molding strips *before* installation, setting the nailheads and touching up with a paint stick.

On the following pages, other basic procedures are outlined, including door and window remodeling and finishing a basement. The latter requires much framing and furring. Ideally, the inside surface of below-grade walls should be coated with asphalt (or other waterproofing) and a plastic vapor barrier before furring strips are applied. If you then lath for plaster, the furring provides an air space that helps insulate and avoids dampness.

Kit-installed pocket doors are most easily framed into new partition walls, like the one shown on the blueprint, page 405. Often it's quicker to nail a partition together flat on the floor, then raise it in place. But be certain to cut the studs over ¾ in. short for ceiling clearance. You can then drive a 1 x 4 strip under the sole plate to wedge the top plate against the ceiling (or joists).

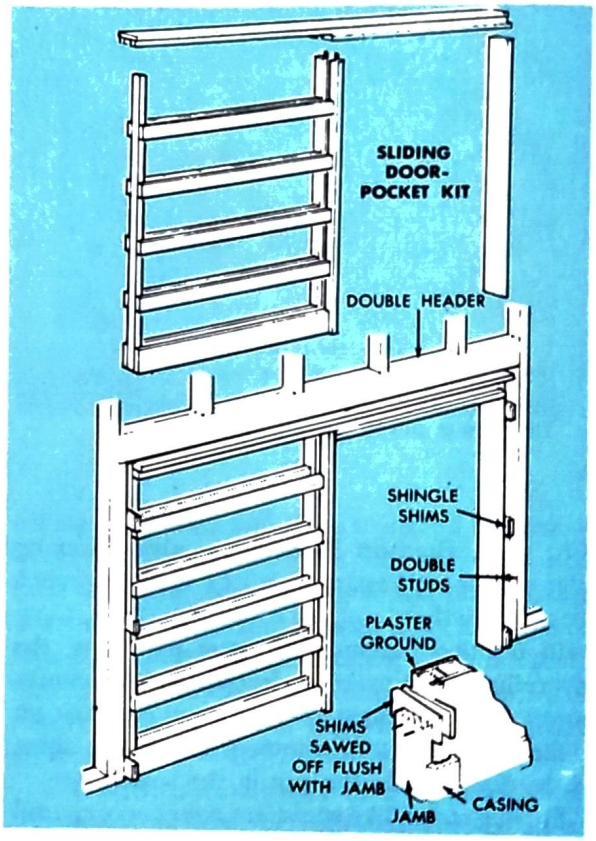
Pocket sliding doors

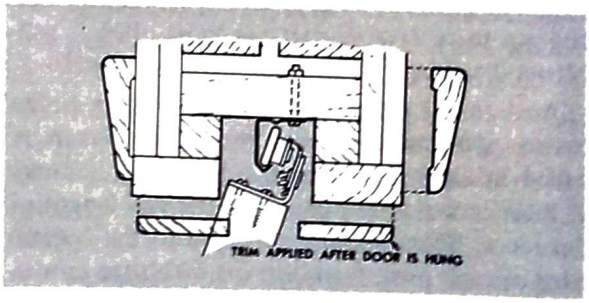
Only one type of door makes sense in the corner arrangement below: track-riding panels that tuck back into the hollow partition walls. Hinged doors, here, would only create congestion and steal space—and they'd probably have to be mounted so they would bang together.



Pocket-door kits differ; they range in price up to $20 and may include the pocket assembly, upper and side jamb, top track, bottom guide and roller hardware—but rarely the door itself. You can cut an opening for a kit in an existing wall, framing it like an ordinary doorway.

Tack the rear of the pocket to the inside trimmer with pairs of shingle shims inserted in the joint as shown at the right. After plumbing the pocket by tapping on these tapered shims (using a plumb line suspended from above as a reference), nail through each pair and trim off excess. At the opposite side of the opening, plumb the face jamb the same way. Attach the two hangers to the top edge of the door, and hang the panel by tipping it until the rollers seat in the track. To level, turn the adjusting screws.

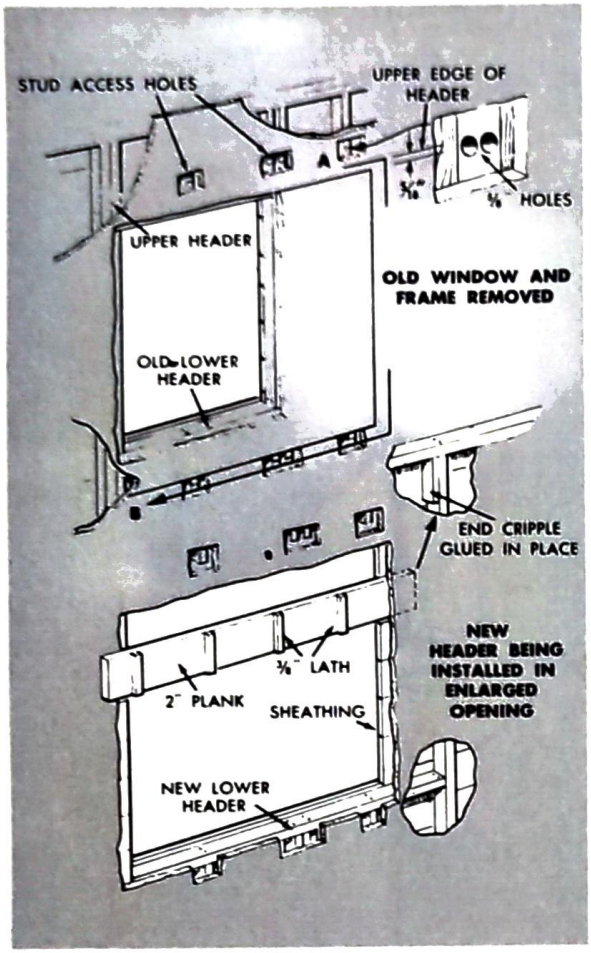




Replacing small window with larger one

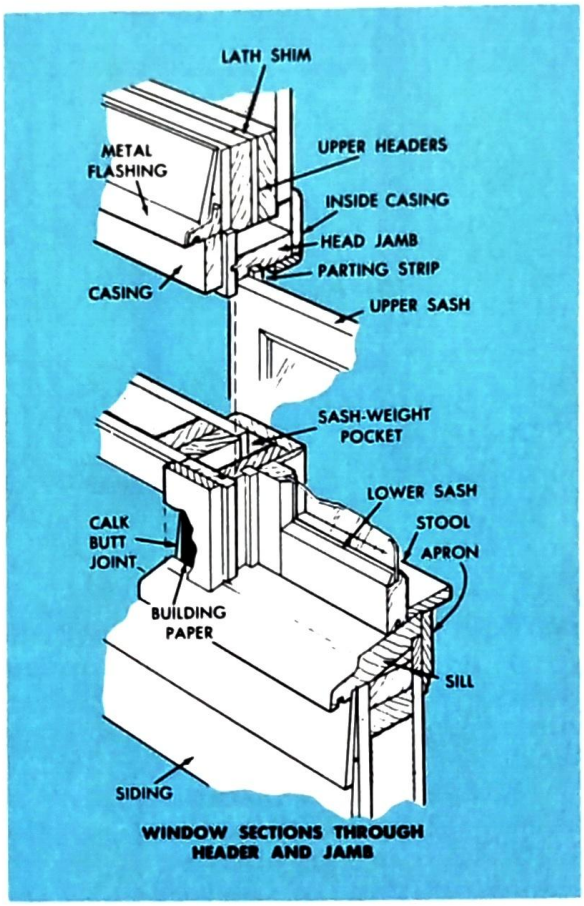
Are you enlarging an opening? Do you want to put a big window where there is now a small one? Here are some tips on how to do the job.

To disturb as little of the finished wall as possible, try to utilize two sides of the existing opening, cutting from A to B in the drawing below.



Chop small holes to permit access to the studs at the top of the upper header and the bottom of the lower. Trim off the studs by boring holes into them and severing the web between holes with a chisel. Hammer and pry the old headers free.

You may find that nailing the right end of the lower header to the first uncut stud inside of the wall is a tight squeeze. Insert only half of the upper header at first, with spacer-lath attached as shown above. Tap the second plank in beside it and spike the two together. Then drive this assembly up against the cripples, prop both ends up to hold it in position, and toenail the cripples to the header through the access holes.



WINDOW SECTIONS THROUGH HEADER AND JAMB

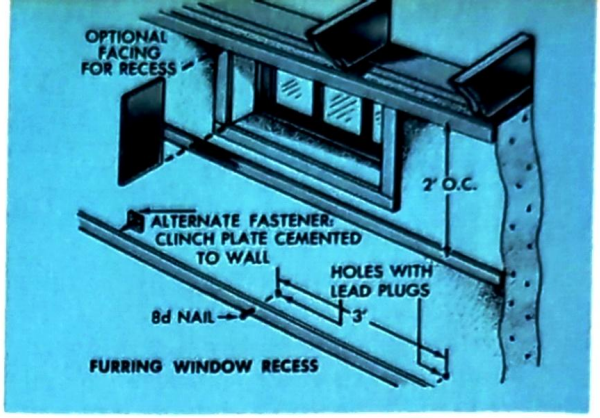
Prepare the access holes for patching by driving large-headed nails into the studs and headers, letting them project ¼ in.

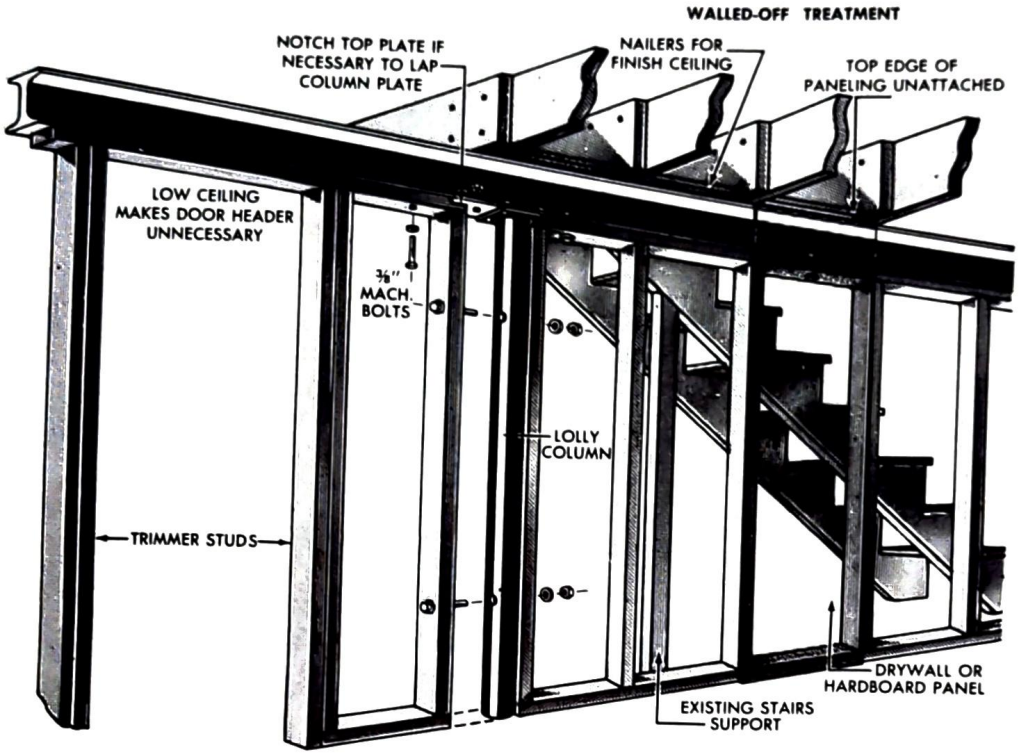
The cutaway of a double-hung window above shows how a framed opening is finished. Trim back the exterior siding for a tight butt joint against the casing. Pry up the siding so that you can insert a strip of building paper under it and across the joint to make it weathertight.

Waste space bonanza

The first area most homeowners turn to when pinched for living space is the basement. But an unfinished cellar looks like a formidable chore because of those cold masonry walls and other eyesores that must be screened from view.

To panel the walls, however, you need only

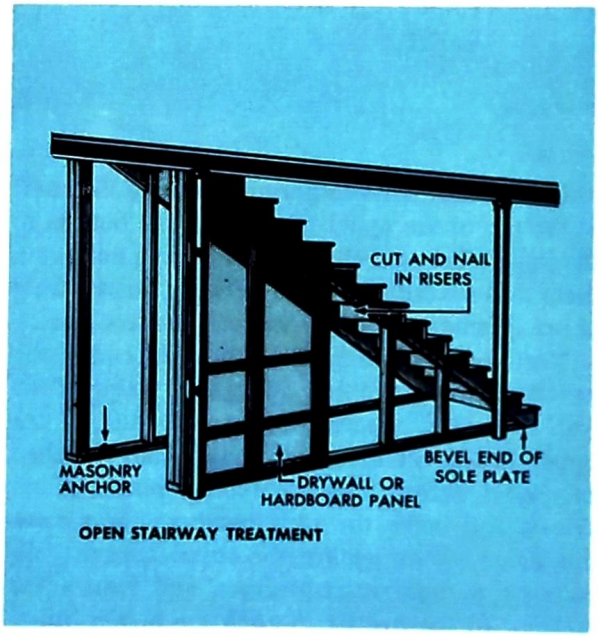



WALLED-OFF TREATMENT
NOTCH TOP PLATE IF NECESSARY TO LAP COLUMN PLATE
NAILERS FOR FINISH CEILING
TOP EDGE OF PANELING UNATTACHED
LOW CEILING MAKES DOOR HEADER UNNECESSARY
⅜" MACH. BOLTS
LOLLY COLUMN
TRIMMER STUDS
DRYWALL OR HARDBOARD PANEL
EXISTING STAIRS SUPPORT

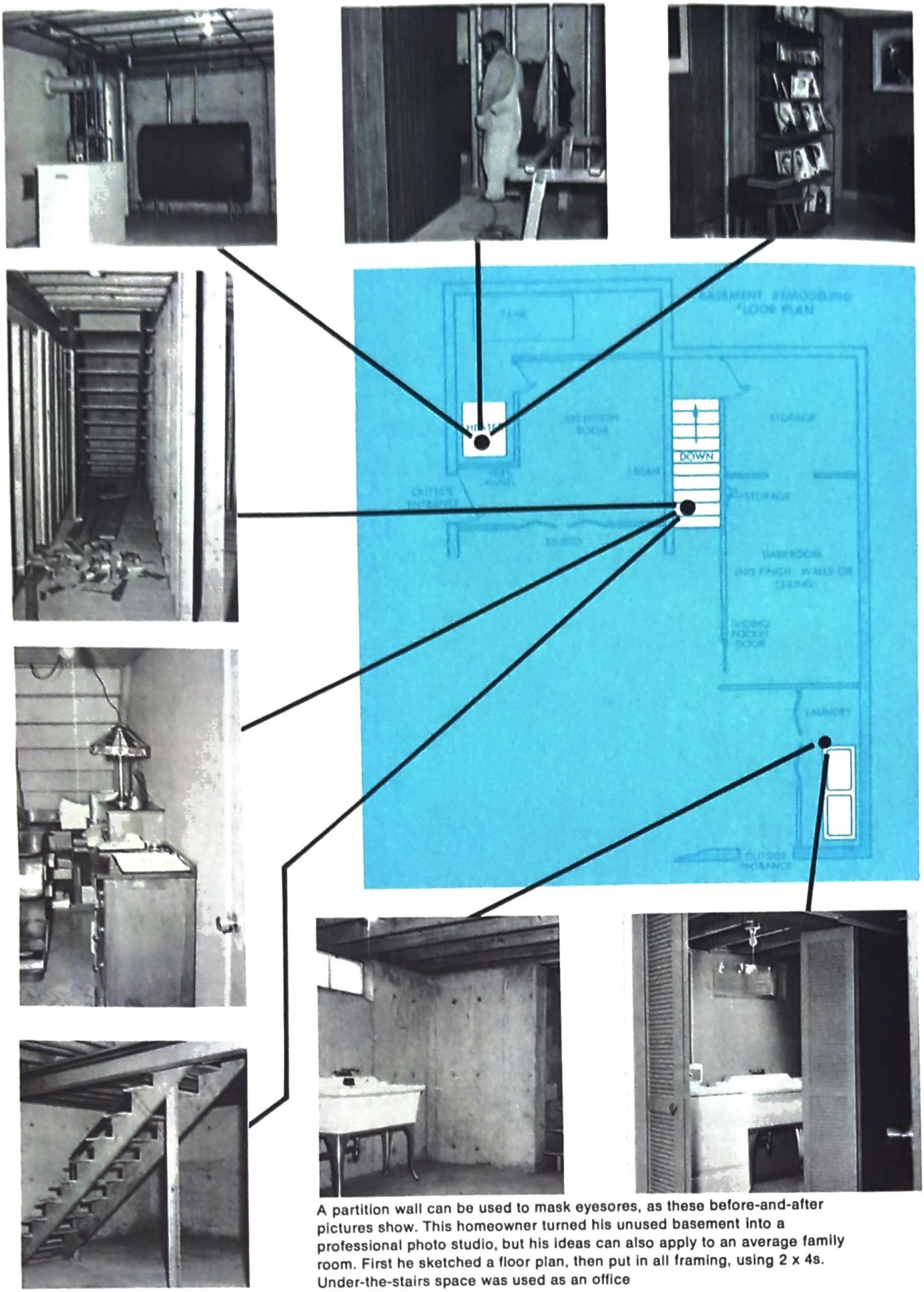
building basics, continued

drill holes for nail anchors that let you attach furring strips. It's still quicker, if the concrete is sound, to use masonry nails, or clinch plates. Applied horizontally—as for plank paneling—furring can be more widely spaced than usual.

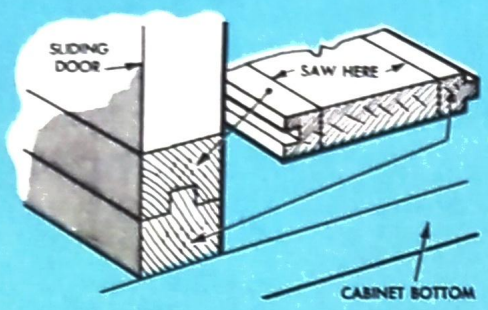
And even the usual clobbered-up basement stairway will take on a respectable look if you nail risers between the treads and enclose the area beneath. If the stairs are hopeless, you can conceal them behind a floor-to-ceiling partition, as shown above, perhaps incorporating an I-beam and lolly column into the new wall. Or trim the panels to the step outline to avoid the necessity of a top plate. You may still be able to tie into the lolly column—bolting through spacer blocks if necessary—to add rigidity.



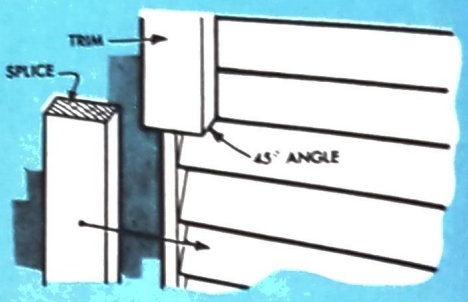
See also: dormers; framing; garages; home additions; lumber; measurements; nails; roofs; sheathing; siding; storage buildings; vacation homes.



A partition wall can be used to mask eyesores, as these before-and-after pictures show. This homeowner turned his unused basement into a professional photo studio, but his ideas can also apply to an average family room. First he sketched a floor plan, then put in all framing, using 2 x 4s. Under-the-stairs space was used as an office

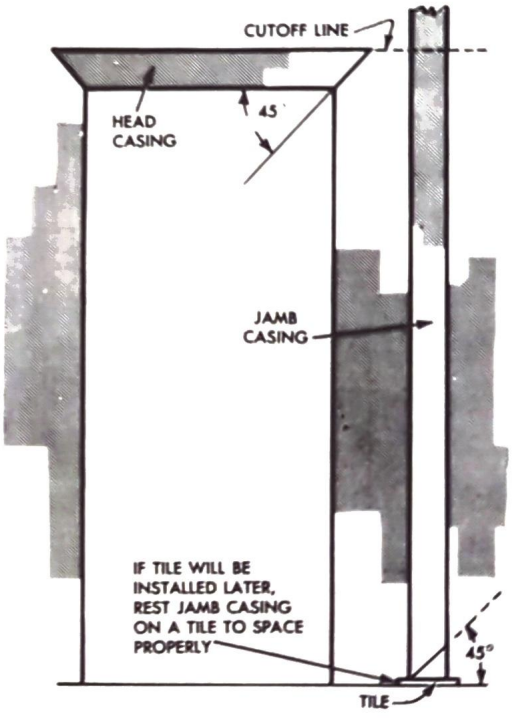


One way to install sliding cabinet doors without hardware is to rip the tongue and groove edges from a length of flooring. Cut the tongue into lengths to fit the opening, top and bottom, and nail in place. Nail pieces from the grooved strip to the top and bottom of the door. Sand flush, then apply filler



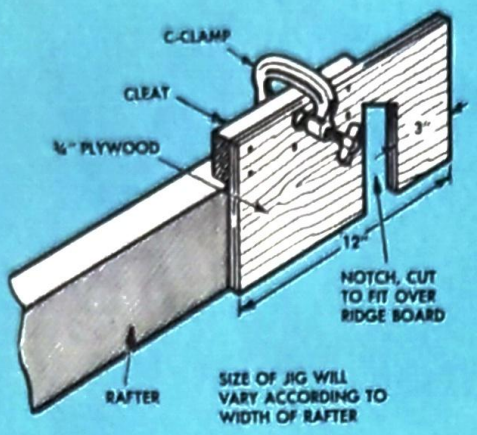
When it is necessary to install corner boards in more than one piece to prevent waste, cut joining ends at a 45-deg. angle, prime the cut ends and join as detailed, driving nails into the lower piece upward at a slight angle to draw the joints tight. This splice prevents water from entering the end grain

Tips from builders

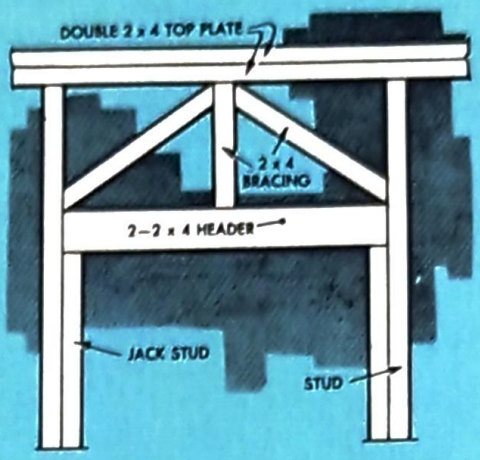


When installing mitered door trim, use this trick to get a perfect fit of the mitered jamb members: Miter and nail the head trim piece, place it against the wall with the mitered end down, mark it as detailed and cut it off square

buildings, storage: see storage buildings
bulletin boards: see animal pin-ups; boys' projects; gifts, Christmas
bullets, wax: see ammunition; targets
bunk beds: see bedroom furniture
burglar alarms: see alarms, burglar; electronics; transistor radios
burnishing: see tumbling machines

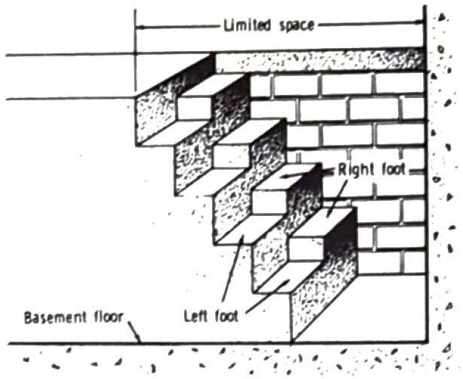


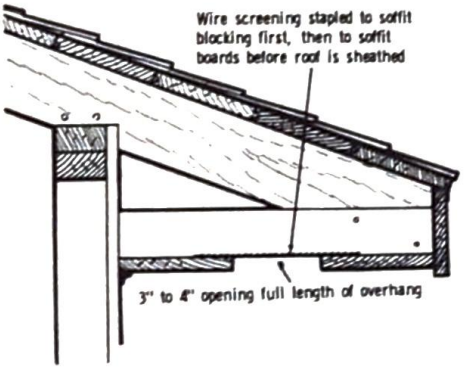
A rafter jig, made by notching a piece of plywood at an angle to fit over the ridge board, enables one man to erect rafters easily. The cleated jig is clamped to the upper end of the rafter, which is then lifted, and the notch in the jig is dropped over the ridge board to hold the rafter securely for nailing



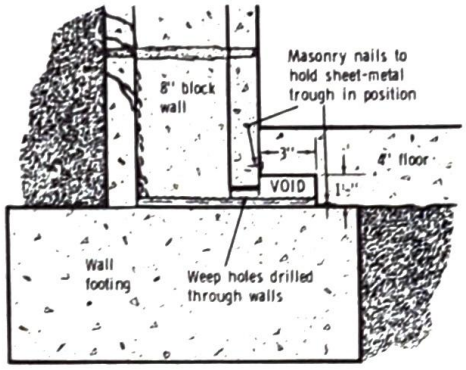
One good way to frame an opening, in either old or new work, is to install a double 2 x 4 header with the ends bearing on jack studs as detailed. Then install 2 x 4 bracing in the opening over the header. This system prevents cracks in the plaster around the opening when it is used in a load-bearing partition

Don't settle for steep, hard-to-climb stairs in cases where horizontal space is limited. Instead, construct your stairs with two risers per step forward, as shown at right. This same design will work just as well in wood, and might come in handy for stair access to an attic through an existing closet




Wire screening stapled to soffit blocking first, then to soffit boards before roof is sheathed
3" to 4" opening full length of overhang

When building a shed or other small structure, you can provide low-cost ventilation by using edge trimmings from fly screen for cornice soffit venting. Just staple strips of screen to the soffit framing midway between the wall and edge, install soffit boards, leaving the screen exposed and staple the edges of the screen to the soffit boards before applying roof sheathing. This prevents moisture accumulation



If you're building a house with a block foundation, have a local sheet-metal shop make up troughs, as shown above, and install these on top of the footings next to the walls before the floor is poured. These should lead to a sump. Such a drainage system will take care of any seepage which runs down through the hollow-core blocks

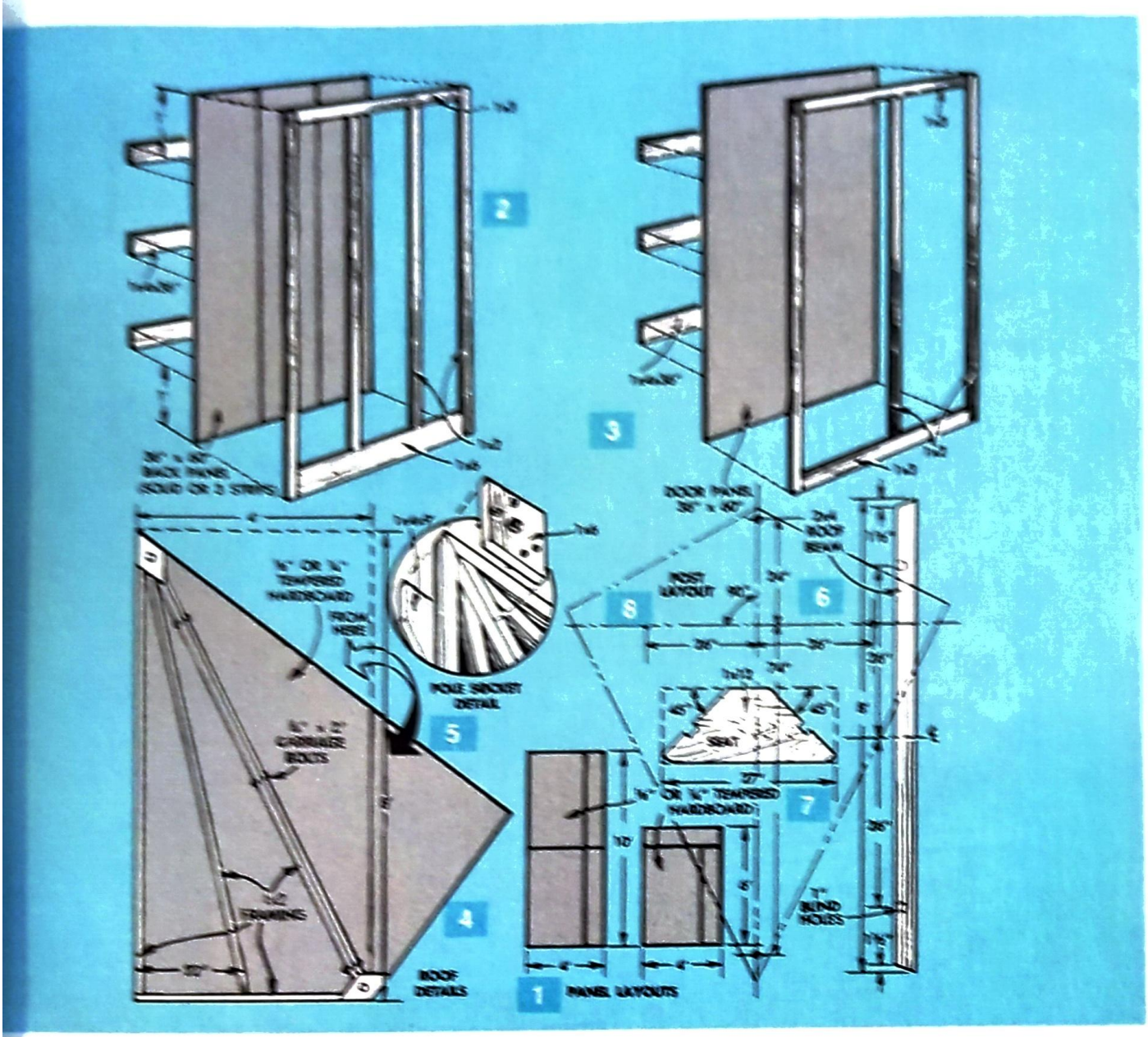
Poolside cabanas

EVERY POOL should have a cabana. Here are two designs that are both novel and attractive.

kite cabana

When not being used as a dressing room, this colorful unit functions as a shade and windscreen. The actual panels are cut from tempered hardboard, smooth on both sides, and steel pipe is utilized for supporting poles. Use ¼-in. hardboard for a year-'round cabana, and ⅛-in. if you plan to dismantle the unit in the fall. Begin by cutting a 4 x 10-ft. panel and two 4 x 6-ft. panels according to the panel layouts, Fig. 1. Next, saw a 4 x 8-ft. sheet diagonally to form the two roof pieces. Paint each of these panels with a good exterior undercoat, being careful to cover the edges so that the hardboard is completely sealed. While the paint is drying, cut the various frame members and paint.

For neatness, use ¾-in. binder-head sheet-metal screws to attach the door and side panels to the inside framing, Figs. 2 and 3. The 1 x 4 outer frame strips should be secured with 1½-in. No. 10 galvanized wood screws. Be sure to drill

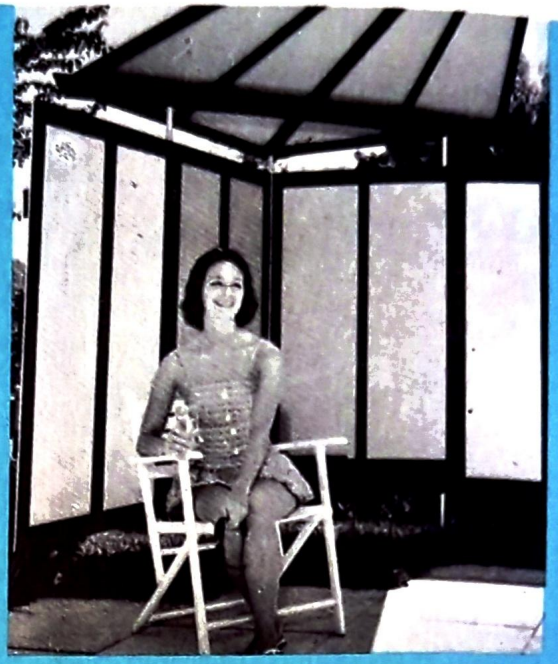


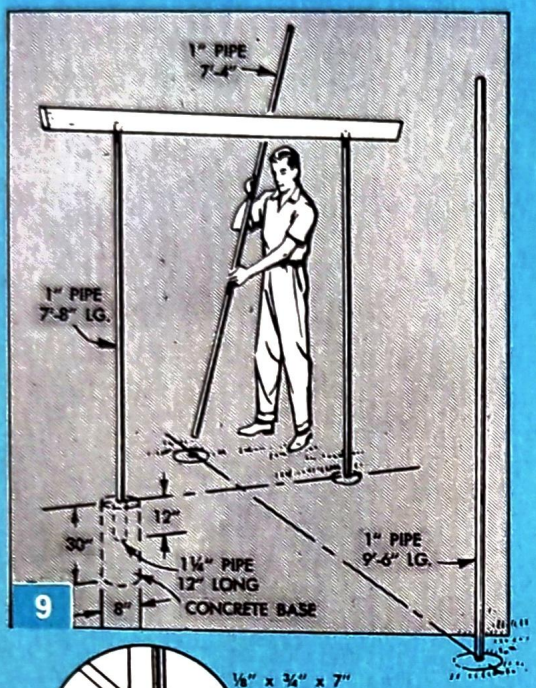
lead holes in the hardboard and pilot holes in the wood.

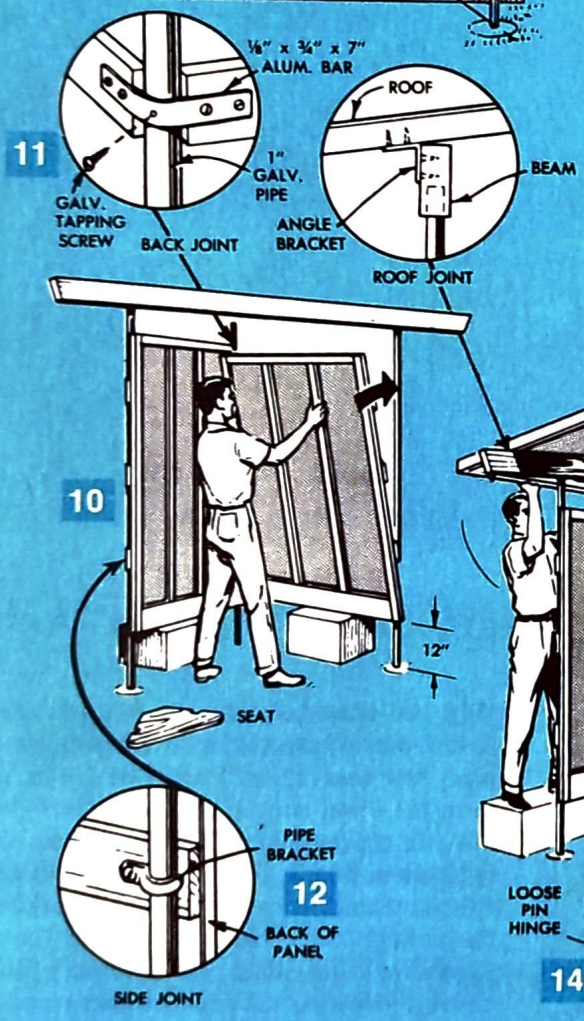
Fit the roof panels together on the driveway or other flat surface and saw the 1 x 2 roof framing to fit, Fig. 4. Attach the framing with ¾-in. binder head, sheet-metal screws. Saw the 1 x 4 cover board and the triangular pole sockets, Fig. 5, but don't bolt the top panels together until final assembly.

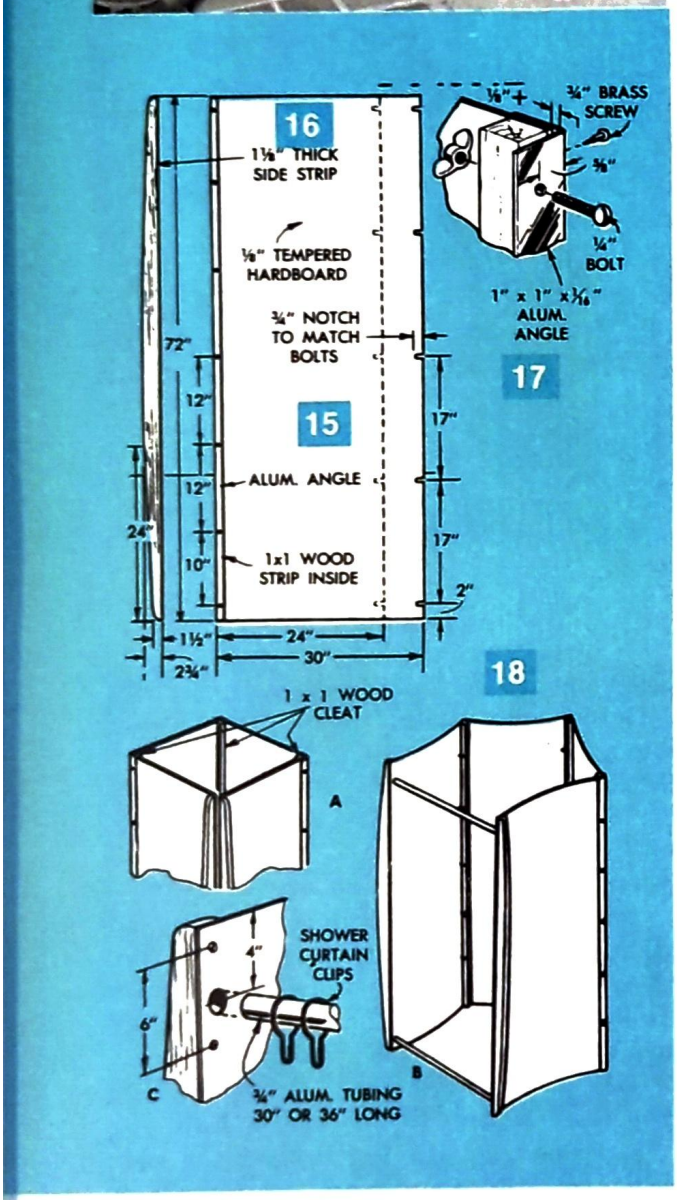
Cut 1-in. galvanized pipe to the required lengths for the poles, Fig. 9, and saw the 2 x 4 roof beam, beveling the end as indicated, Fig. 6. Drill two blind holes for the poles in the beam to a depth of about 1 in. While you are cutting pipe, saw four 12-in. lengths of 1¼-in. pipe to form the lower sockets for the poles.

After choosing a site for the cabana, lay out the pole positions, Fig. 8. Dig 30-in.-deep holes 8-in. in diameter for a base at each location. Fill these holes with concrete around the 12-in. lengths of pipe. While the concrete is still wet, insert the poles into these sockets and check them with a carpenter's level to make sure that the sockets are absolutely vertical. After the




1" PIPE
7'-4"
1" PIPE
7'-8" LG.
12"
30"
1¼" PIPE
12" LONG
CONCRETE BASE
8"
1" PIPE
9'-6" LG.
9


⅛" x ¾" x 7"
ALUM. BAR
11
1"
GALV.
PIPE
GALV.
TAPPING
SCREW
BACK JOINT
ROOF
BEAM
ANGLE
BRACKET
ROOF JOINT
1x4 x 9' JOINT
COVER
10
12"
SEAT
13
PIPE
BRACKET
12
BACK OF
PANEL
SIDE JOINT
LOOSE
PIN
HINGE
DOOR
14



concrete has set, insert the poles and add the 2 x 4 roof beam, Fig. 9.

Rest the side panels on blocks or boxes while erecting the cabana, Fig. 10. Use pipe brackets to fasten the side panels to the front poles, Fig. 12, and flat steel to attach both panels to the rear pole. When the two panels are in place, cut out the seat and nail to the 1 x 6 bottom frame member of each panel, Fig. 7.

The roof is next. Attach the two panels along the centerline with 3/16 x 2-in. carriage bolts, Fig. 4. Then fasten the post pads in place with 1½-in. No. 10 wood screws, turn the assembly over and attach the cover board over the center seam. With the aid of a helper on a stepladder, raise the roof to the top of the cabana and make sure it rests evenly on all four poles, Fig. 13. Then attach it to the beam with angle brackets, Fig. 11.

Support the doors on blocks or boxes while you mount the hinges, Fig. 14. To keep doors closed, use a simple hook-and-eye catch. A drop-down aluminum bar can be screw-fastened to the inside edge of a door frame to hold the doors open.

portable cabana

Easy to put up or take down, the walls of this lightweight unit are made by cutting two 4 x 6-ft. hardboard panels of ⅛-in. tempered hardboard in half lengthwise. Cut these panels and all framing members before beginning construction. Drill and countersink holes for ¾-in. aluminum wood screws in the three lengths of aluminum angle. Then screw-fasten these angles to the panels and 1 x 1 cleats, leaving a ⅛-in. slot between each undrilled flange and 1 x 1 cleat. Add tapered door posts to the end panels, Fig. 16, and drill blind holes through the hardboard and into these posts, Fig. 18, for the ¾-in. aluminum tubing.

Next, slip two panels together and drill holes for the ¼-in. bolts, Fig. 17. Since holes will not be drilled at exactly the same locations in all panels, key matching panels. Pull the panel out of the slot and, using the drilled holes as guides, saw notches in the edge of the hardboard, Fig. 15, so you will be able to assemble and dismantle the cabana by merely loosening the wing nuts.

To set up the cabana, slip the panels into the slots and tighten the bolts, then spring the two side panels apart and brace them with aluminum tubing inserted in the blind holes at top and bottom. The shower-curtain door must be attached at top and bottom so it won't blow open.

See also: filters, swimming pool; grotto; patios; swimming pools; vacation homes; yard lights.

When the flap is raised to form a patio for your camper, the cabana offers a shaded space for a card table and chairs

As a dressing room, the cabana provides an area 3 ft. deep and nearly 5 ft. high and wide. The camper's threshold makes a handy seat. The rear of the fabric is snapped to the camper body all around

For complete privacy and protection from drafts and rain, a skirt is snapped in place on the camper and at the lower ends of the cabana sides as well. The fabric is reinforced wherever snaps are mounted

Tuckaway camper cabana

BY JACK STOWELL

■ HAS YOUR SLEEPING CAMPER got you down, literally, when it comes to dressing? You can solve your cramped-space problem with this canvas-and-pipe cabana, which not only provides the convenience of a stand-up dressing room, but converts to a dining fly as well.

While designed for the teardrop camper shown, the cabana can be adapted to any hardtop or bus-van camper.

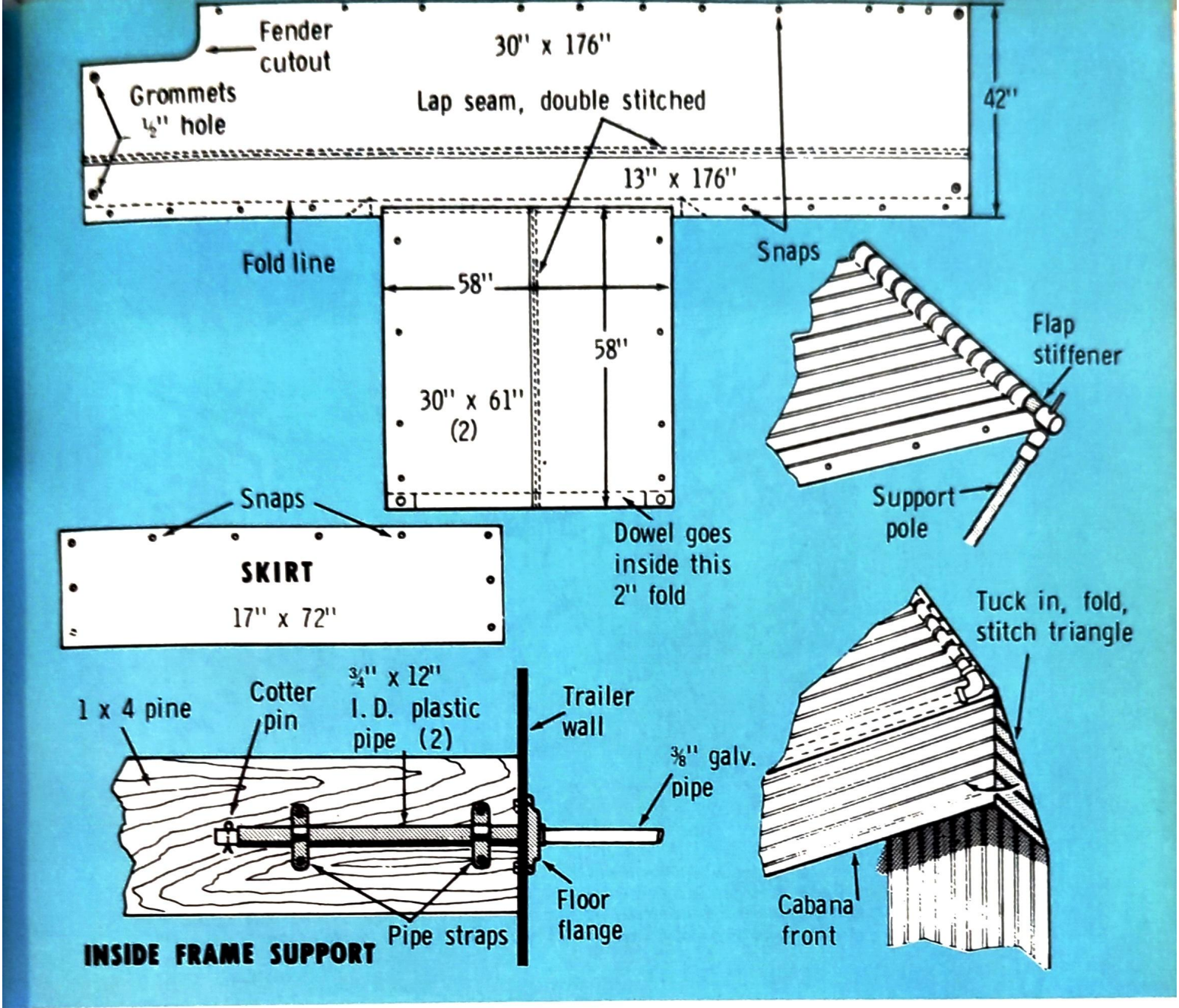
The striped cover is awning material, hung over a pull-out supporting frame made from ⅜-in. i.d. galvanized pipe. The cover is stored inside the camper. The frame slides in two 1-ft. lengths of ¾-in. plastic pipe attached to the underside of the camper's roof. These sleeves are clamped with pipe straps to 1 x 4 braces fastened with calked machine screws to the roof.

Outside, the plastic pipes extend 1/16-in. through a pair of reamed-out ¾-in. floor flanges bolted to the camper's side. When tucked away, the pipe framework makes an effective watertight seal. To keep it from being pulled out, run cotter pins through holes near the pipe ends.

Sew the canvas cover with heavy thread, lapfelling and double-stitching all seams. Add 2-in.-square reinforcing pieces where grommets are to be placed. Make a skirt to fit from the bottom of the camper to the ground.

Take the cover and skirt to an auto-top shop. Buy screw-in studs for the camper body.

To support the flap, buy tent poles or make your own. For compactness, cut four 2½-ft.



lengths of ¾-in. dowel. Cut two 1-ft. lengths and four 3-in. lengths of ¾-in. copper tubing. Drive a 3-in. piece onto an end of each dowel for reinforcement; crimp it into the wood in two places, using a wheel tubing cutter. On the other end of two dowels, push on the 1-ft. tubes 6 in. to create female sockets for joining the poles. Crimp.

Drill into the four ends with the 3-in. collars so as to force-fit ¼ x 4-in. cold-rolled rods 2 in. deep. One pole tip goes into the ground; the other through the grommets.

To stiffen the front edge of the flap, use ⅝-in. dowels and copper tubing in the same way. On the outer ends, however, force on 1-in. collars and drill 5/16-in. holes through copper and wood to accept the pole tips. This stiffener is slipped into a stitched fold. A slit near each end short of the grommet lets the stiffener project through the canvas.

Besides serving as a convenient portable dressing room, the cabana can be used as a patio for your camper. When the flap is raised, it provides a shaded area for your card table and chairs.

Remember to build and stitch the frame and canvas carefully. Although the cabana is easy to set up and take down in a hurry, an unexpected wind will put a lot of stress on it.

You also may find it helpful to buy some extra canvas and build a bag for storing the cabana awning. Since the canvas is kept inside the camper, this will keep it neat and out of the way.

The arrangement of the doors and shelf shown here is just one of many possible plans for the buffet. The only limitation is the dimensions of the grilles. You might wish to design the interior as a cabinet for your stereo. If so, strongly braced extra shelves would be needed. Deeper sides would make it a fine record cabinet

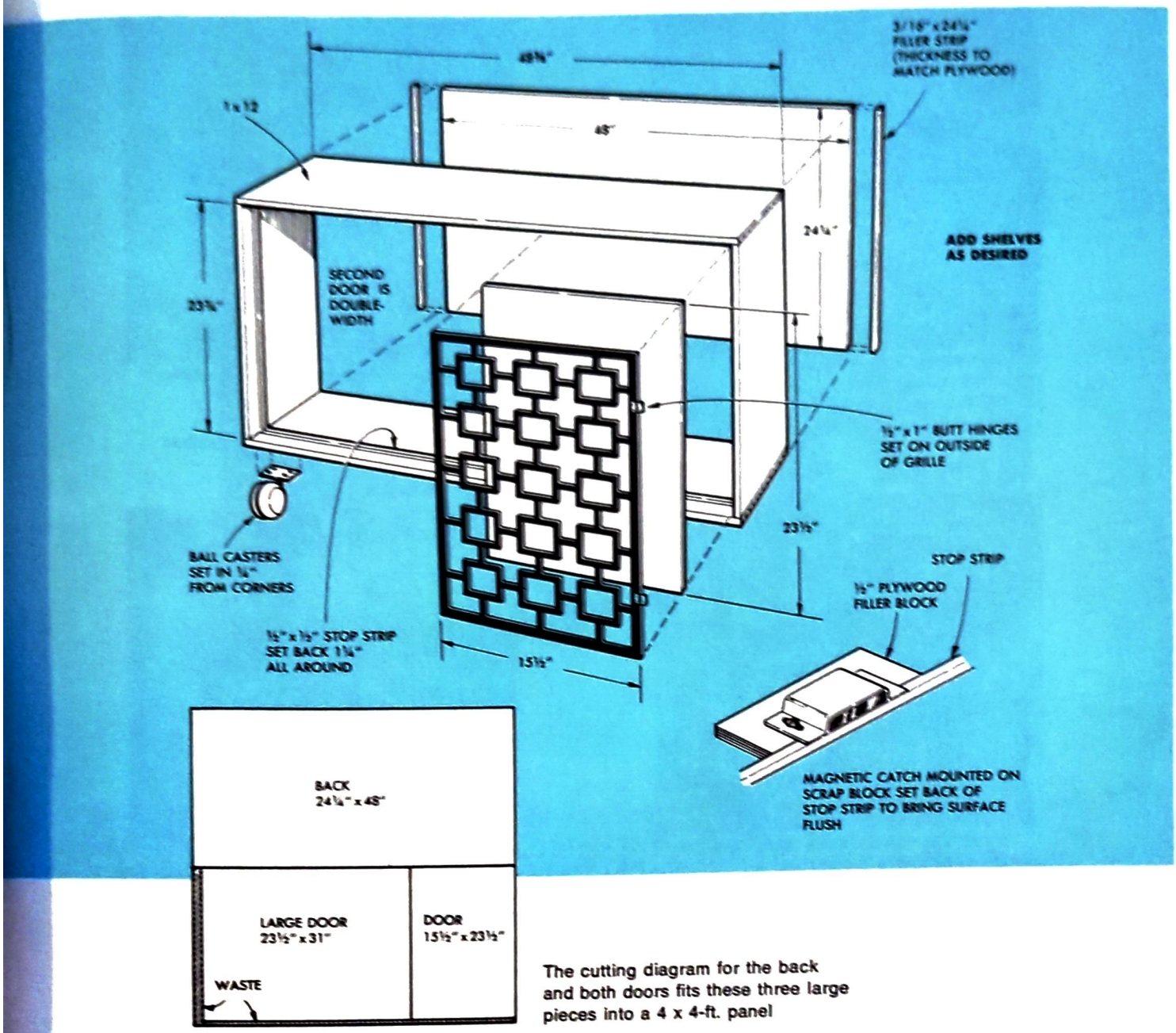
High-style cabinet

BY GEO. DANIELS

■ THIS CLEAN-LINED modern buffet is a striking example of the styling miracles you can perform by adding a few unusual "extras" to a common project. Basically just a simple box-type cabinet made from inexpensive materials, the addition of ball casters and three low-cost, die-cut plywood door grilles to the buffet transforms it into a smart decorator's piece.

Though the ⅛-in. plywood grilles are available in a number of sizes and designs, a 15½ x 23½-in. panel in a square pattern was chosen because it would yield the desired proportions and seemed best suited to the straight lines of the piece. Since the total grille area determines the overall size of the cabinet, and in turn the amount of ¾-in. plywood required for the doors and back, the use of three grilles of this size allows you to cut these pieces from a half sheet of plywood leaving almost no waste. If you wish to make the shelves deeper, substitute ¾-in. plywood for the 1 x 12 pine.

To make the unit as illustrated in the drawing on the opposite page, begin by cutting the 1 x 12 top, bottom and side pieces to the lengths indi-


3/16" x 24¼" FILLER STRIP (THICKNESS TO MATCH PLYWOOD)
49¾"
1 x 12
48"
24¼"
ADD SHELVES AS DESIRED
SECOND DOOR IS DOUBLE-WIDTH
23¼"
½" x 1" BUTT HINGES SET ON OUTSIDE OF GRILLE
23½"
BALL CASTERS SET IN 1¼" FROM CORNERS
STOP STRIP
½" PLYWOOD FILLER BLOCK
½" x ½" STOP STRIP SET BACK 1¼" ALL AROUND
15½"
MAGNETIC CATCH MOUNTED ON SCRAP BLOCK SET BACK OF STOP STRIP TO BRING SURFACE FLUSH

The cutting diagram for the back and both doors fits these three large pieces into a 4 x 4-ft. panel

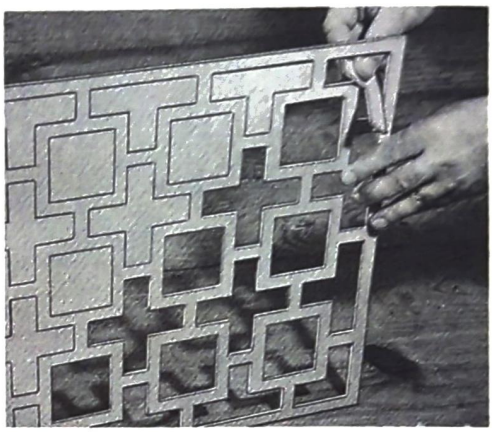
cated. Then assemble these, using six countersunk 8d. finishing nails at each corner, Fig. 1. These nails, plus the added rigidity supplied by the back panel, will be sufficient to hold the cabinet in square under normal conditions of use. However, if it must support especially heavy loads (large plants on top, a great deal of china inside, hi-fi equipment, etc.), you might add further reinforcement by installing corner irons or cleats at the corners on the inside.

Next, cut the doors and back from half of a 4 x 8-ft. sheet of ⅜-in. plywood, following the cutting diagram above. You will note that the back panel is only 48 in. long, while the outside length of the cabinet must be 48⅜ in. in order to provide clearance for the doors, so it will be necessary to add a 3/16-in. filler strip to the back panel at each rear corner, Fig. 3. Fasten the back panel to the top, sides and bottom with 1-in. No. 16 wire nails, mounting it with the factory-cut edge at the top so that you can use the plywood corners as a guide to square up the cabinet. After adding the 3/16-in. filler strips at either end, attach the ½ x ½-in. stop strips just inside the front of

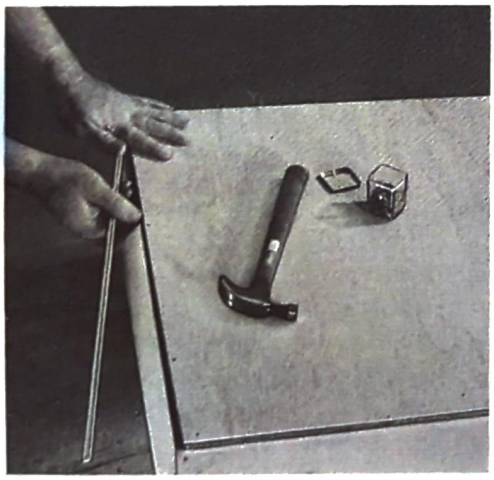
1. Six finishing nails at each corner will provide a joint of sufficient strength for this cabinet, provided that you don't plan to use it for weighty storage

4. Mount the ball casters with their plates set ¼ in. from the edges. Besides being decorative, the casters make it easier to clean under the cabinet

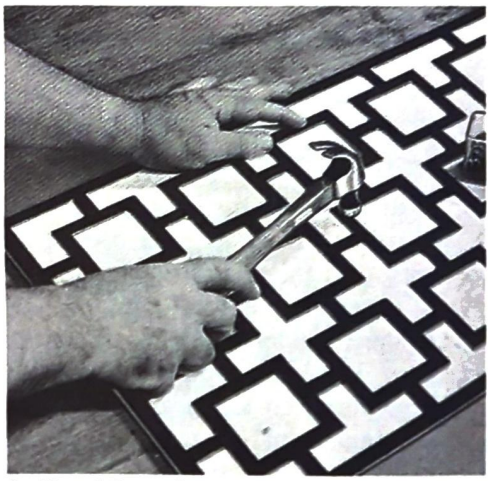
2. To seal the end grain, try applying a thin coating of cellulose cement with a spatula, then scraping off the excess. It dries in a hurry and is a real timesaver



5. Die-cut grilles are sold with the cut-out sections still in place. Push these out from the side that the die entered and mount on the doors with this side out



3. Use brads to mount the two $\frac{3}{16}$-in. filler strips on the rear corners. These are necessary to bring the corners of the rear panel out square with the cabinet's sides



6. Mount the grilles on ⅜-in. plywood door panels with brads at each corner, in the center of each side and at several points around the center section

the cabinet, setting them back 1¼ in. from the edge. This completes the cabinet assembly.

Before mounting the ⅛-in. plywood grilles on the door panels, you'll have to remove the cut-out sections since these will still be in place when you purchase the grilles. The side from which the die entered is the one which will be exposed, so punch out the scraps from this side to assure that any splintering will occur on the concealed rear surface, Fig. 5. You'll find that these sections will come out easily if you start at a corner and press firmly just inside the cut.

As the grilles and door panels must be painted separately before being assembled, this is a good time to finish the entire cabinet. Fill nail holes and ill-fitting joints with wood putty, then sand all surfaces smooth. After sealing the end grain, Fig. 2, give the cabinet and door panels a coat of plywood primer-sealer. The buffet shown here was painted black and white—black semi-gloss enamel on the grilles and cabinet, and white flat enamel on the door panels as a background color. However, any two colors which contrast well could be used. You may even wish to use three colors, painting the grille doors black and white and the rest of the cabinet in a bright enamel (blue, red, green, etc.). After the paint dries, turn the cabinet over and attach the ball casters, Fig. 4.

Use brads to mount the grilles on the door panel, so that you will be able to remove them without damage if you should wish to change the color scheme sometime in the future. Then attach ½ x 1-in. butt hinges to the assembled doors by driving screws through the grille overlay and into the panel. Mount small wooden drawer pulls in the doors in the same way. Next, slip the doors into the cabinet, one at a time, supporting them at the proper height against the stop strips with a couple of pieces of waste from the grilles, and attach the hinges to the sides of the cabinet.

To complete the buffet, paint the hinges, drawer pulls and brad heads to match the grille color. Finally, install magnetic catches to hold the doors closed.

See also: children's furniture; gun cabinet; hardboard projects; hobby workspace; home improvement; kitchens; laundry; radiator covers; remodeling; remodeling ideas; serving center; spice chest.

uild this unconventional speaker system that splits the music on your hi-fi and stereo records so you can pick out each instrument in the orchestra, from anywhere in the room

Interflex—a new speaker system

BY EARL STOWELL

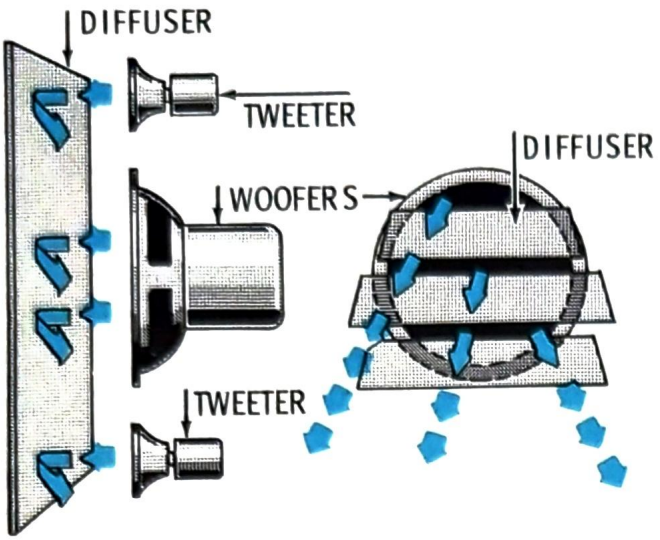
■ HERE'S A REALLY FINE SPEAKER system for the reproduction of hi-fi and stereo sound.

Interflex does many things. It separates each voice and instrument. It spreads the sound over the entire listening area (there are no sound beams or favored spots). It works from your existing mono or stereo amplifiers. It provides the effect of being in the hall in which the original program originated. An orchestra sounds like one in your living room—in effect, Interflex seems to join your room to the original hall.

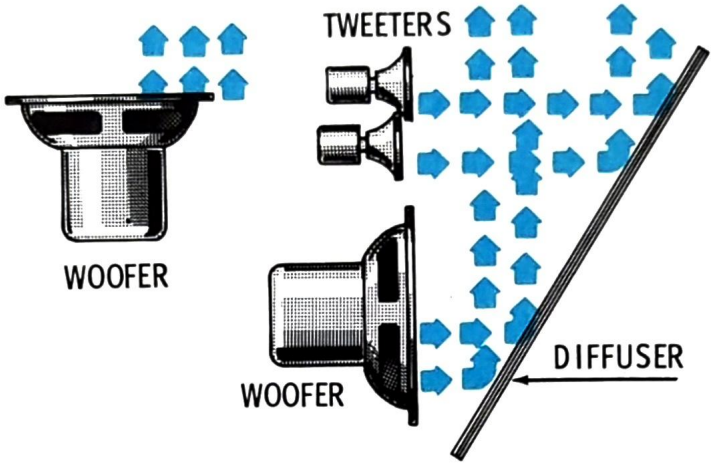
Interflex starts by reflecting the speaker output off diffusers which direct each frequency into the room in a dispersed beam, but at a slightly different angle from every other frequency. Wonderful instrument that it is, the ear assembles the frequencies into their proper places.

Also, Interflex uses a pair of folded horns of different lengths. Because of the elasticity of the air and the type of loading used, they act as an infinite number of different-length resonators, both quarter-wave closed and half-wave open, to that part of the sound energy reflected back into the tapered horns. They also act as eighth-wave closed resonators to trap some energy between 45 and 90 cycles per second, eliminating speaker and cabinet resonance in this range.

A discontinuity in each horn gives a bass-reflex action and causes the dual effect of acting as quarter-wave and half-wave resonators. Diffusers inside the cabinet eliminate the need for cabinet padding and add to the effect gained by crossing the sound beams of two speakers at critical angles to produce the beats that give original hall sound. This effect can be used because sound waves are longitudinal instead of transverse. A special back-loading device adjusts to tune out the last trace of cabinet resonance.



Out of the diffuser slats comes the output of one woofer. The other woofer and the two tweeters feed the big diffuser which reflects the sound into the room



Another view of the sound travel, this time looking down from the top of the cabinet. The diffuser does much more than reflect sound into the surrounding air

The backloading device is a port in the back (A), covered on the inside with a 2-in.-thick pad of spun glass between two layers of ¼-in.-mesh hardware cloth. Ten screws used around the edges compress the spun glass until the speakers work against the same load, front and back, as evidenced by no cabinet rumble or boominess. Compressing the spun glass down to just under an inch will be about right.

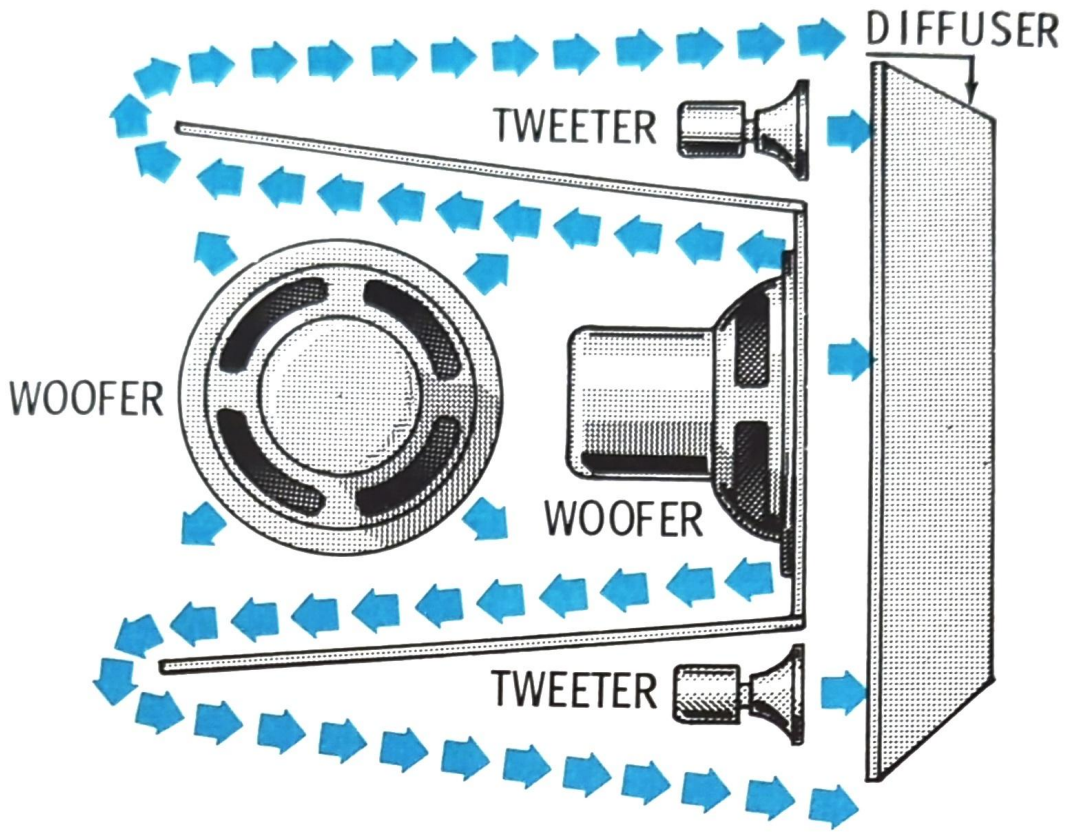
Use plenty of glue on all joints. Before closing the cabinet, fill the cracks between horn sides (F & G) and speaker panel (L) with wood dough or putty. A ½-in. crack at this point would act as a trap to a note with a 4-in. wavelength. Install the back with 1 or 1½-in. wood screws spaced 4 to 5 in., and then follow the same procedure across the back of main diffuser E, too.

The bottom opening is part of the low-frequency trap. If you use the cabinet in upright position, cover the opening with hardware cloth and grille cloth and allow about 3 in. between this face and a wall.

The cabinet as shown was designed so the grille can be tipped back for the sake of appearance. However, it isn't necessary to make your cabinet so complicated if you wish to simplify it. You can build the inner box, decide whether to stand it on end or on the side, veneer only the exposed sides, and then put legs under the cabinet.

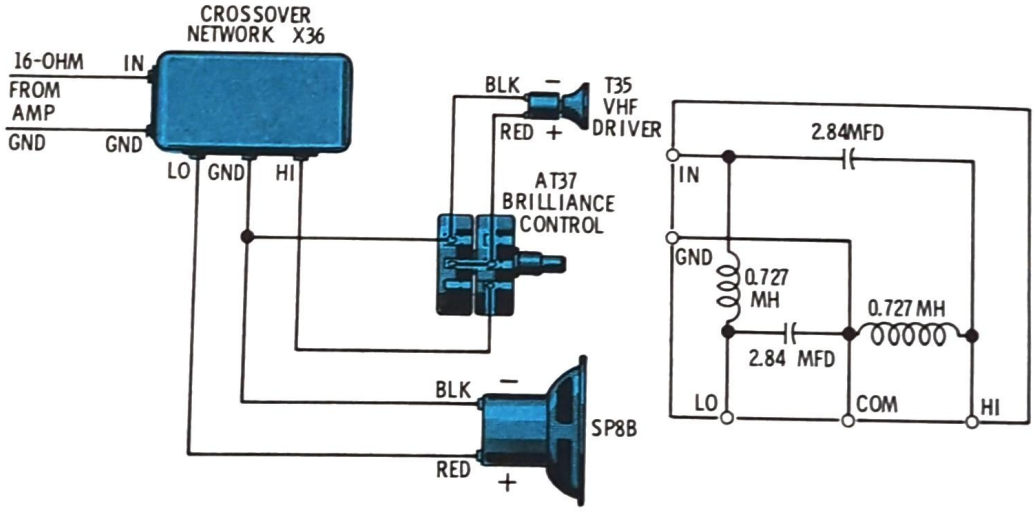
You can work out the grille in the most convenient way for you. Don't use upholstery cloth, though, or any other ordinary cloth over the grille. Use a coarse woven plastic grille cloth which you can obtain at any electronics supply house.

A word about the front diffuser, important to overall results. If you use the cabinet upright, rotate this diffuser 90°.

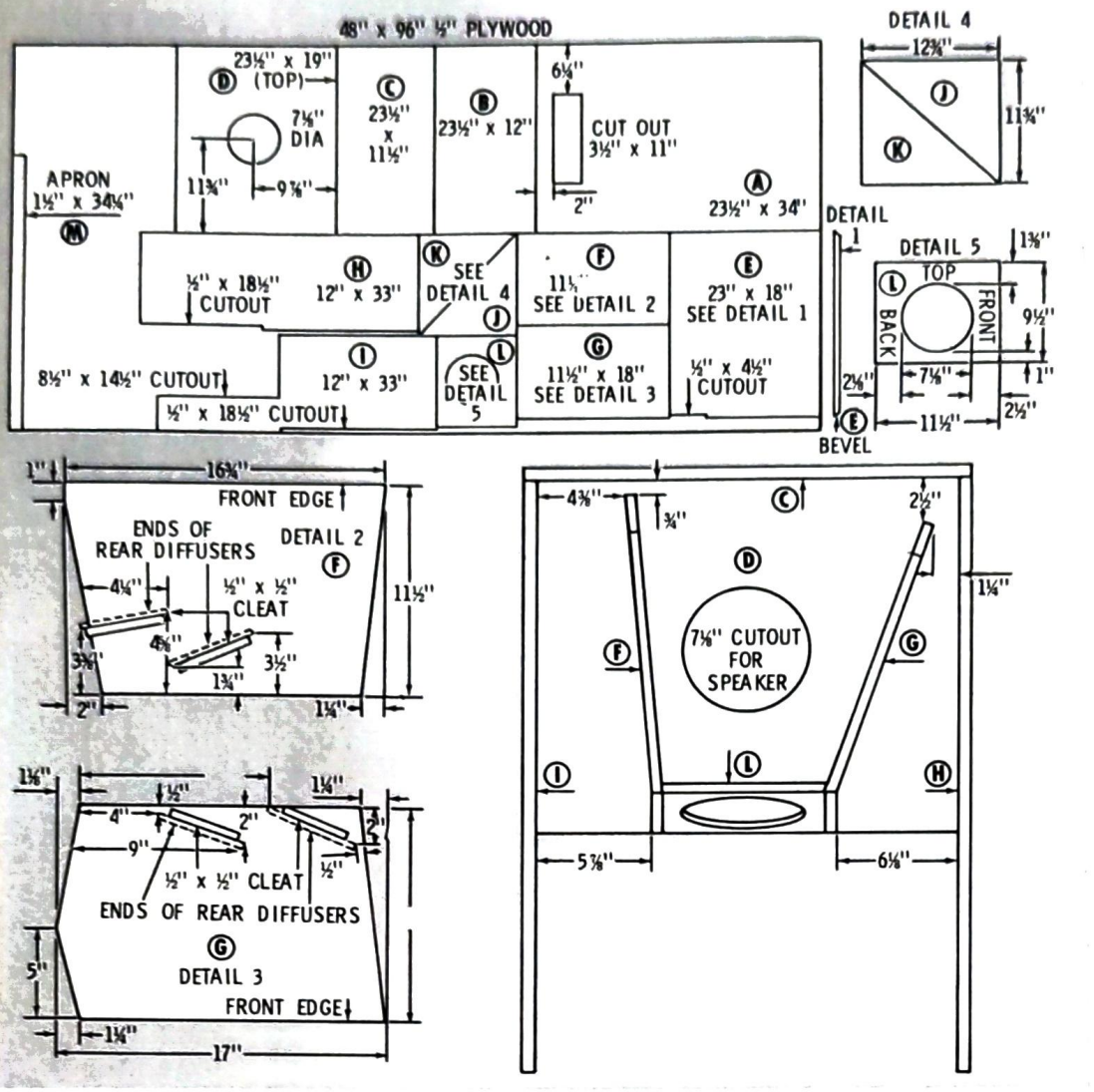


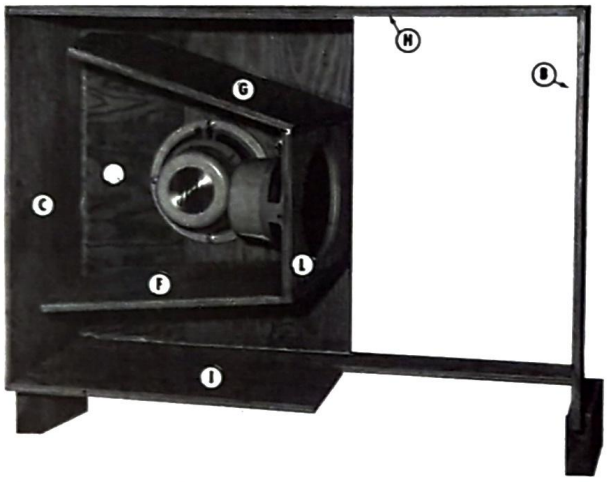
The folded horn effect becomes clear when you look from the back. It reinforces the direct flow shown in the other sketches. Some sound also goes through the bottom port

interflex, continued



Electronic circuit shows the hookup of one of the two speaker pairs. Two pairs are required for a stereo speaker setup. The circuit at right is an exact configuration of the crossover networks used in the system





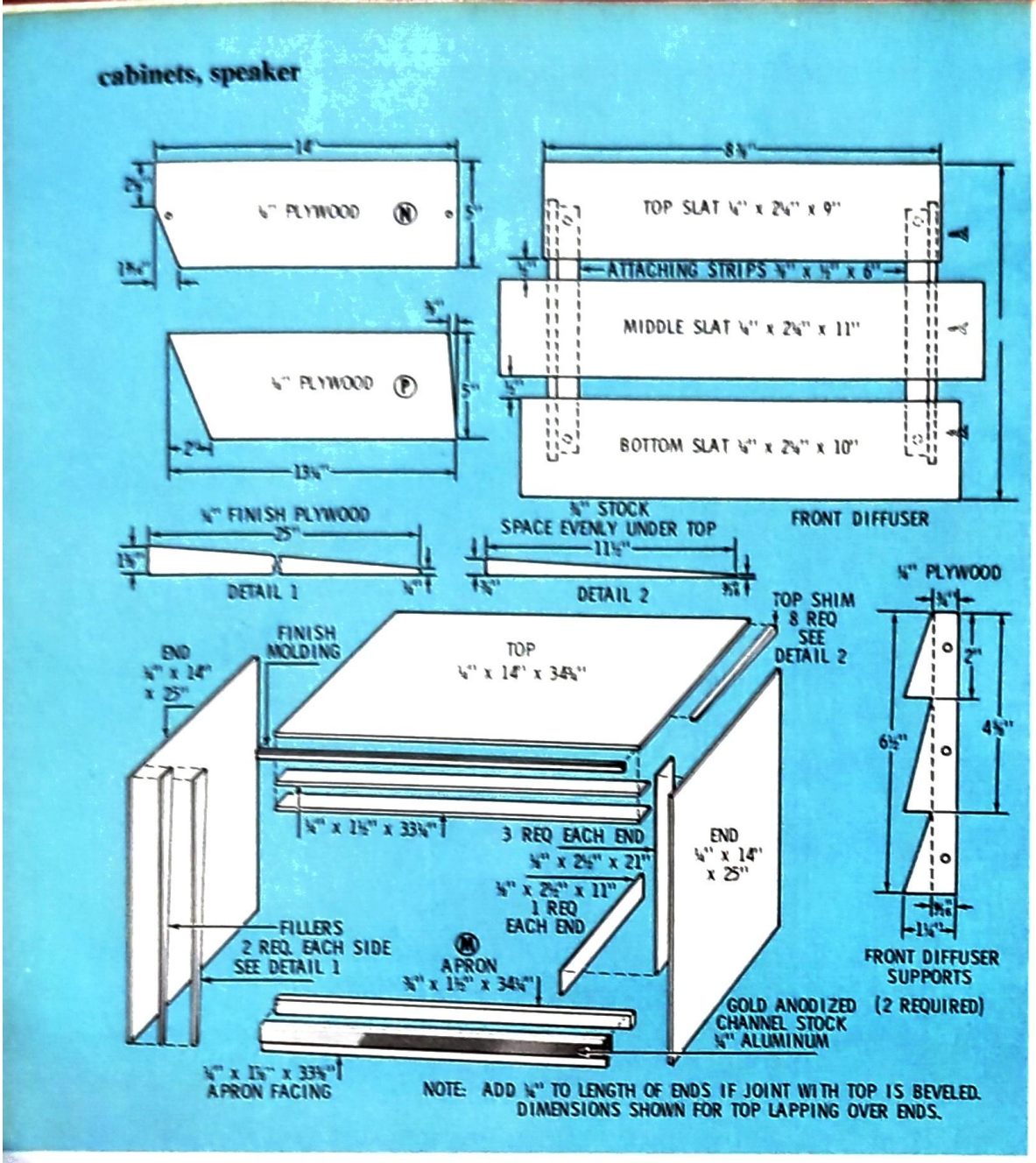
A partial assembly view of the cabinet shows bass speakers mounted in place. Install the tweeter packages next. When all speakers are mounted, you can assemble the remaining parts of the Interflex building blocks and apply a careful finish to the exterior

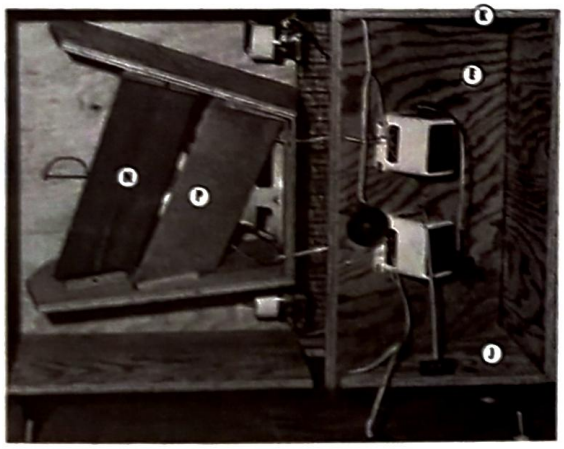
You can use 10-in. speakers in the same enclosure. Simply increase the cutouts to take the larger speakers. If necessary, increase the size of the speaker mounting board. However, do not change the location of the free ends of the folded horn sides.

If you wish, you can use a 12-in. speaker to replace the one facing out of the cabinet. In order to do this, you'll have to move one of the folded horns just a bit, to make room for the 12-in. speaker. The inside speaker, however, cannot be larger than 10 inches.

Another possibility is to use one Stephens 80 FR speaker inside, and use no tweeter or crossover network for that channel. The Stephens is a wide-range speaker and works fine in this cabinet. Such a substitution will cut your costs considerably, and still give you excellent results.

To use Interflex with a mono outfit, parallel the two speaker channels and connect them to



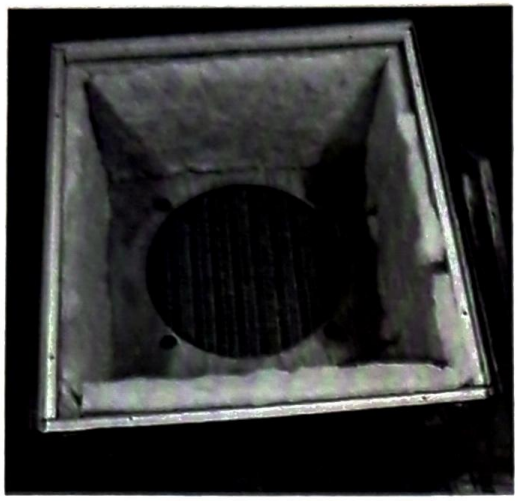


Before the rear cover is attached, a last look inside shows the completed cabinet. Crossover controls are still to be mounted along with the speaker connection terminal strips. All wood parts of the main cabinet are coded to match the earlier sketches

the two speaker channels and connect them to the 8-ohm output of your amplifier. For stereo amplifiers, connect the left-hand channel to the speaker on panel L and the right-hand channel to the other speaker channel. Check phasing by reversing the leads to one speaker channel (with power off the amplifier to protect your tweeters). In Interflex, phasing is very important and you will have no trouble telling which way is correct. One way is warm and full; the other is shrill.

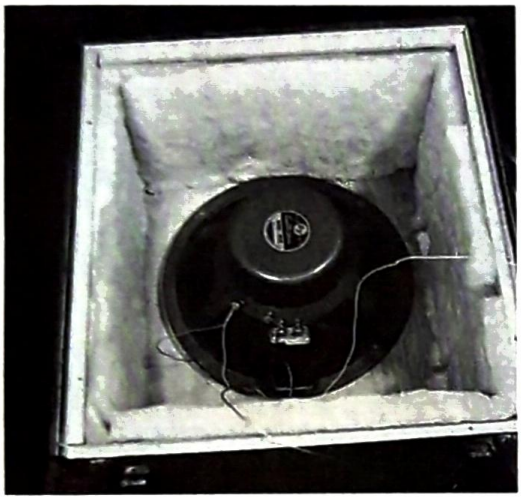
When your system is finished, give the cabinet a week to mellow. Sure, it is heresy to make the cabinet a part of the system; but the longer you use your Interflex, the more the cabinet will mellow. Then turn your system down to whisper-soft level. You will be amazed at the reproduction.

See also: high fidelity; high fidelity center; high fidelity, portable; needles, phonograph; phonographs; radio, stereo FM; record changers.



Open the cabinet, pull out the speaker, and you've taken the first step toward better sound from your present economy-speaker enclosure

Drop a common faucet washer over each mounting bolt to provide an air space for the bass tones to escape from that tight little box



Put the speaker back and tighten the mounting nuts enough to hold it securely in place but not enough to flatten the washers

Better sound from any speaker

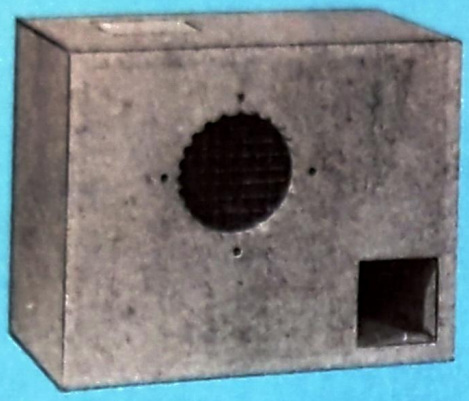
By WALTER G. SALM

■ SPEAKER CABINET too small? Most "bargain"-type enclosures are too tiny to handle a full-size speaker system, even though the mounting hole is the right size.

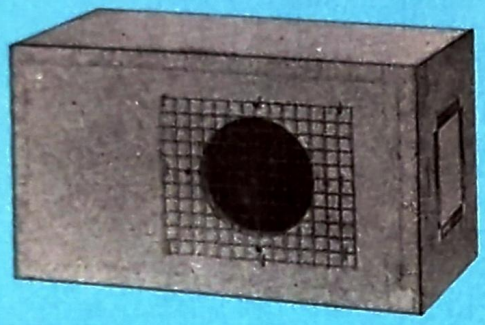
Such a unit is typically an infinite baffle (no bass port or duct) that is just a closed box with a hole for the speaker. Such a box vibrates like mad whenever a decent bass note is fed to the speaker, and you don't hear the full beauty of those rich, deep notes. The best solution is to add a port.

One variation of the bass-reflex principle uses specially designed ports around the speaker to vent the cabinet. The easy and inexpensive way to do this for your setup is to remove the speaker and place an ordinary faucet washer over each mounting bolt (⅛-in. to ¼-in. thick). Replace the speaker and retighten the nuts enough to hold the speaker but not enough to flatten the washers. A good way to tell when they are right is to tighten them until the speaker is held in place but does not rattle.

Now those troublemaking low-frequency notes have a nice big air space all around the sides of the speaker through which to escape. Of course, this doesn't give you a true bass-reflex enclosure, but it will certainly give you a definite improvement over the bargain enclosure you had. You will have eliminated the bass vibration and you'll be surprised at the noticeable improvement.



Finished enclosures: The vented unit is above. The infinite baffle is below. Grille cloth, a coat of finish and some trim are the finishing touches



Big bass, small speaker

by TONY DOSCHEK

FOR REPRODUCED MUSIC to sound good, it must be rich in the low frequencies. To reproduce low frequencies normally requires a large speaker in a large enclosure. We've made a switch. Here are two small enclosures, each one requiring a single 5-in. speaker that goes below 50 cycles.

The cabinets shown here were designed for a particular speaker, the AMD Electronics Model 5A-50. It is 5 in. in diameter, has a 16-ohm impedance, music power capacity of 8 watts, a 2-in.-diameter voice coil and a 45,000 Maxwell magnetic field. However, other speakers with similar specifications can be used.

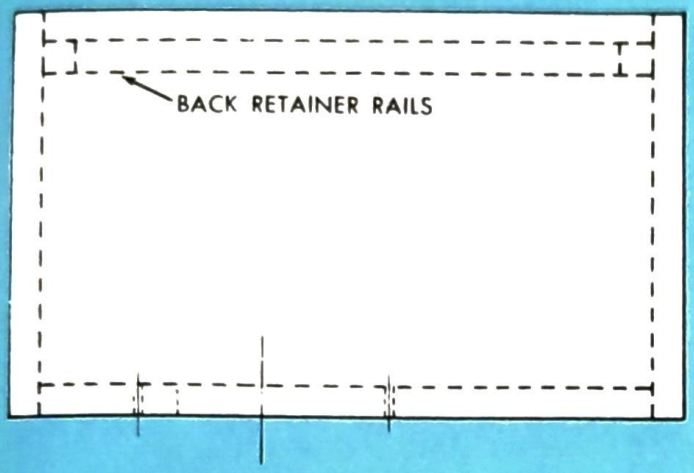
Take the infinite baffle shown on the next page. Despite its tiny dimensions (it measures only 15¼ x 8½ x 9¼ in.) it produces a smooth output of all frequencies in the range 80 to 16,000 cycles.

If more bass is required, try the vented enclosure also detailed on the next page. Its frequency range starts below 50 and goes above 16,000 cycles.

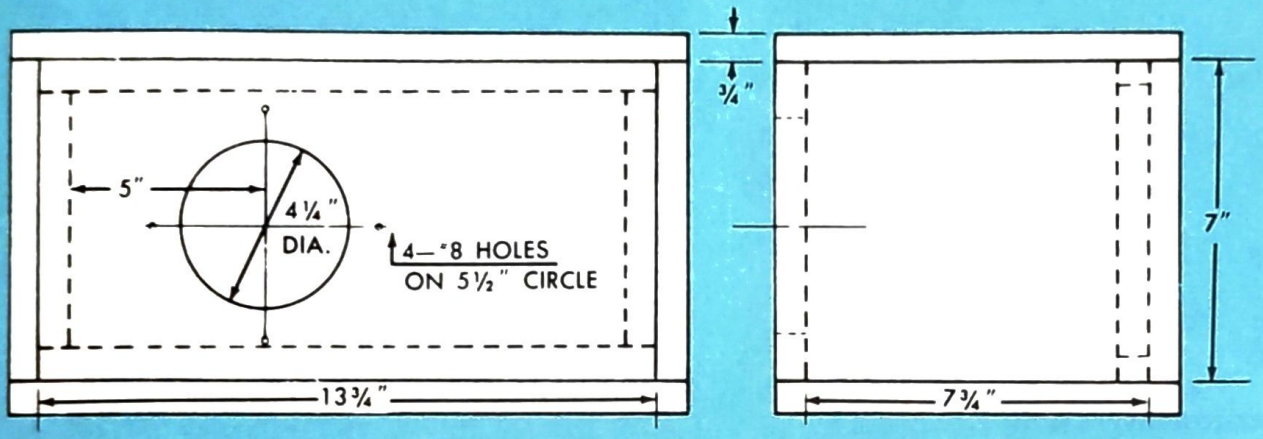
Either one of the compact pair can be used almost anywhere. Add grille cloth and trim to the cabinets and finish to match the room decor.

cabinet hardware: see hardware
cabinetwork: see dove-tailing
caddy, garden: see garden caddy
caddy, welding-tank: see welding
calliope: see parade floats

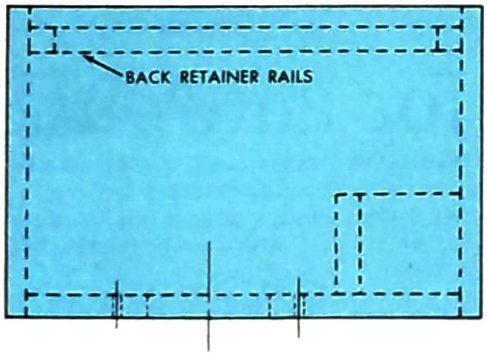
INFINITE BAFFLE ENCLOSURE 15¼ x 8½ x 9¼ INCHES OVERALL



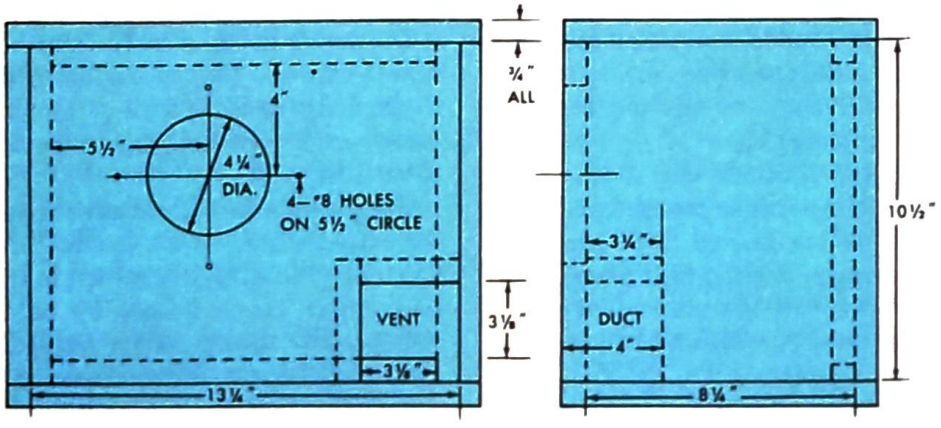
1. MAKE FROM ¾" PARTICLE BOARD OR PLYWOOD.
2. LINE ENTIRE INSIDE WITH #1 OR #2 DENSITY, 1" GLASS FIBER STAPLED LOOSELY IN PLACE.
3. CHAMFER SPEAKER EXHAUST HOLE OR FLUTE FOR IMPROVED MIDDLE AND HIGH FREQUENCY DISPERSION AND AVOIDANCE OF STANDING WAVES.
4. PROVIDE #8 VENT HOLE, ANYWHERE FREE TO OUTSIDE TO COMPENSATE FOR BAROMETRIC CHANGES.
5. PROVIDE TERMINAL BOARD ON REAR FOR SPEAKER LEADS.

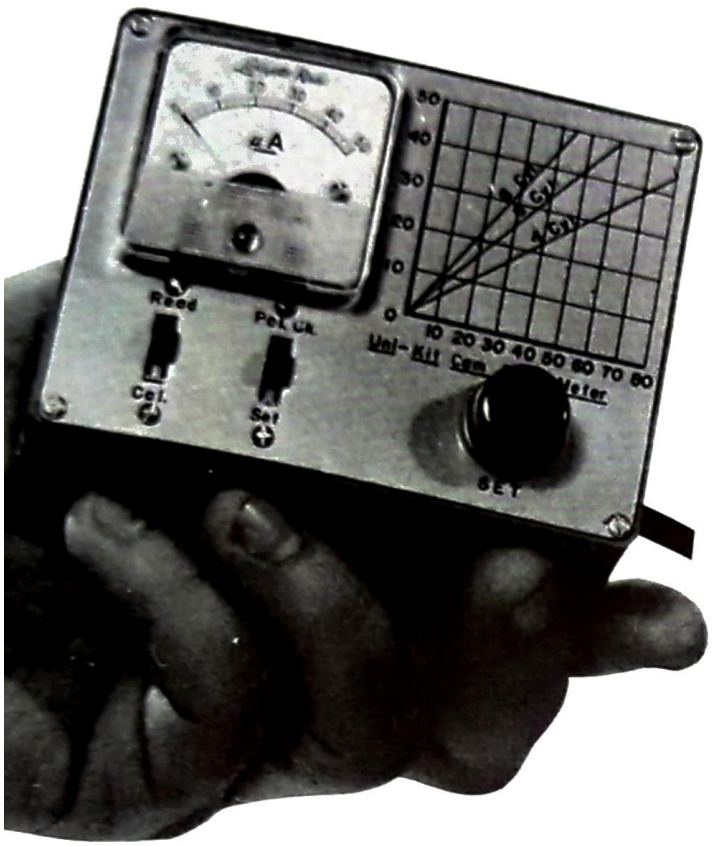


VENTED ENCLOSURE 14¾ x 12 x 9¾ INCHES OVERALL



1. MAKE FROM ¾" PARTICLE BOARD OR PLYWOOD.
2. LINE INTERIOR OF BACK, TOP AND SIDE OPPOSITE DUCT WITH #1 OR #2 DENSITY, 1" GLASS FIBER. STAPLE LOOSELY IN PLACE.
3. CHAMFER EXHAUST HOLE, OR FLUTE, FOR IMPROVED MIDDLE AND HIGH-FREQUENCY DISPERSION AND AVOIDANCE OF STANDING WAVES.
4. PROVIDE TERMINAL BOARD ON REAR FOR SPEAKER LEADS.
5. BACK LOAD SPEAKER WITH 8" SQUARE OF NEOPRENE BACKED #1 DENSITY GLASS FIBER WITH 3" DIAMETER PERFORATION FOR MAGNET COVER. APPLY WITH GLASS FIBER SIDE TOWARD SPEAKER AND STAPLE AT EACH OF FOUR CORNERS ONLY.





Here's a dwell-meter use not covered in the text. Connect the leads across the ignition coil. Full-scale reading indicates open coil. A zero reading means everything's OK

This semiconductor unit that'll fit in your pocket sets dwell—detects bouncing, pitted or burned points, and spots any shorted capacitors

Cam-dwell meter for auto tuneups

BY BRICE WARD

EVER HAVE POINT trouble? Or maybe that spitfire auto is spitting more fire and less power lately. If this is your trouble, here is an instrument that takes up little more space than a pack of cigarettes yet will help you get the engine running smoothly once again.

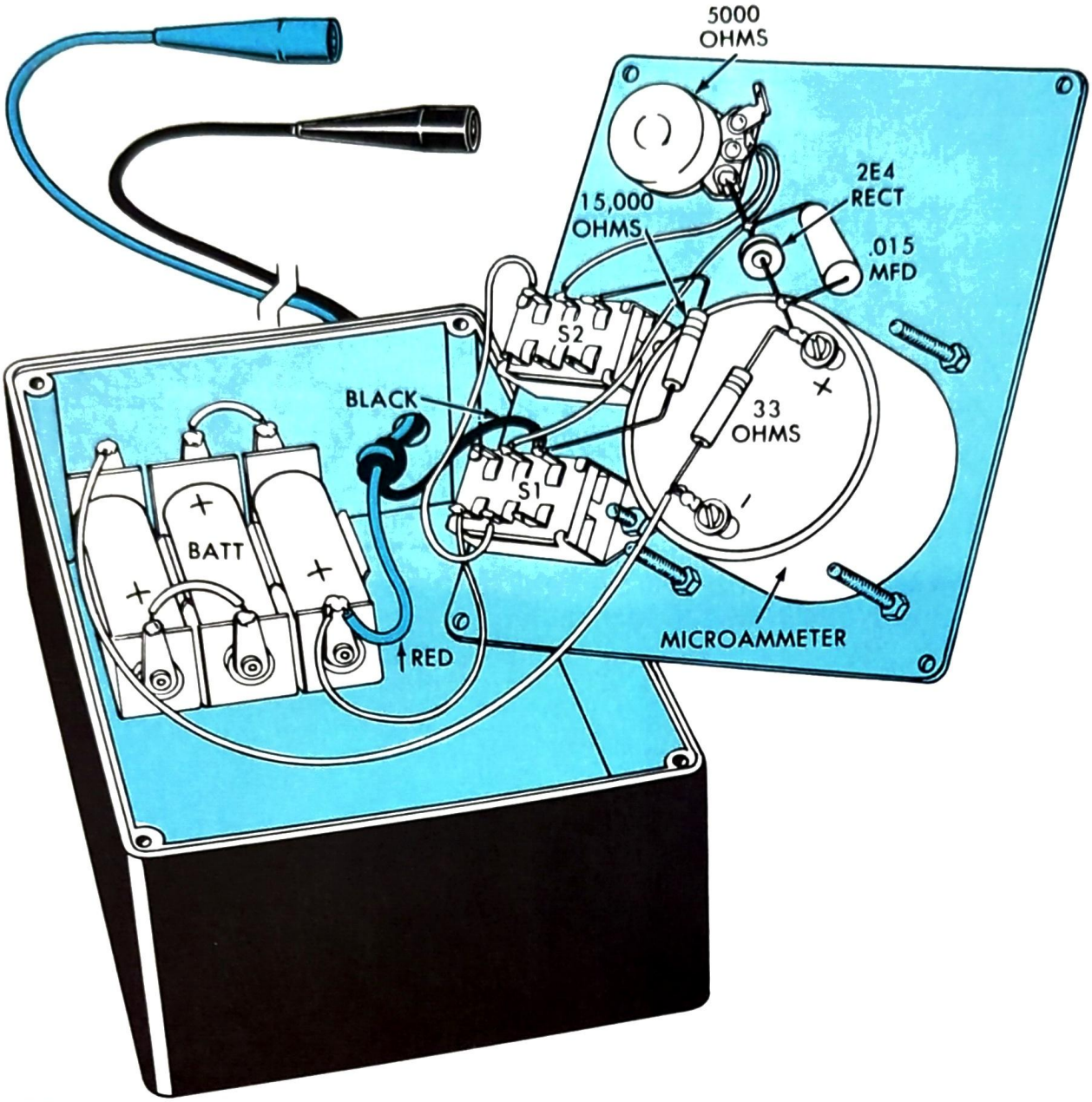
This precision ultra-miniature cam-dwell meter will let you set your points to better than .001 in. (3-deg. dwell) of the desired dwell setting. It will detect bouncing points and high resistance points and do everything the large units will do —all at a cost of about $15.

If you are going to build from scratch, you'll need a case and panel. Drill and punch these to fit the components. Routing of wiring and parts layout are not critical, so construction won't be too tough.

Testing your assembled meter is simple. Place the READ-CAL switch in the CAL position. Place the POL CK-SET switch in the SET position. Adjust the SET knob for full-scale deflection on the meter. Switch the POL CK-SET switch to POL CK and the meter should read 0.

Now connect the test leads together and the

camera case, underwater: see underwater camera case
camera mount: see tripods



Follow this diagram carefully and you'll have little difficulty assembling your cam-dwell meter. Note that the batteries are mounted in a battery holder in the bottom of the case. If you substitute another meter, you may want to use a larger case or one of a different shape

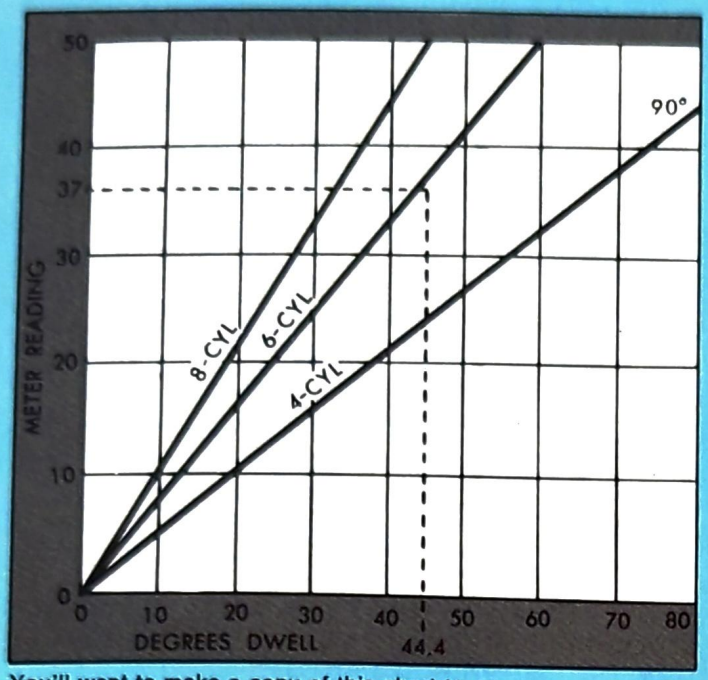
meter should indicate somewhere between 0 and 10. With the READ-CAL switch in the READ position and the test leads still shorted, the meter should again read full scale. With the test leads disconnected, the meter should read 0. If your unit meets these tests it is ready to use.

Connect one lead to ground, the other to the coil terminal at the distributor. Set the switches to CAL and POL CK. If the meter reads strongly up scale, reverse leads; the meter should read below 10.

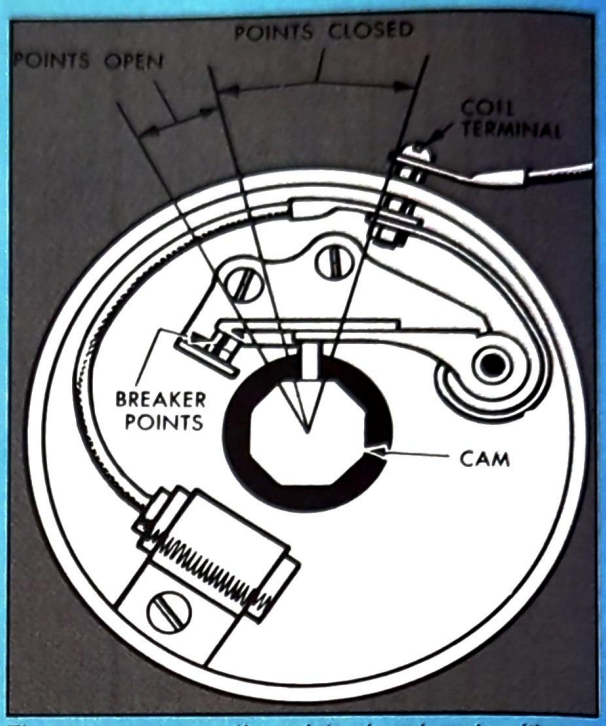
Set the switches to CAL and SET and adjust the SET knob for full-scale indication on the meter. Set the switches to READ and SET, and read percentage dwell on the meter.

The meter reading must be multiplied by two for true percentage-dwell reading, but for a quick dwell indication go to the chart. Follow a line over from the meter reading on the chart to the 8, 6 or 4-cylinder line and drop straight down to get the dwell reading. For example, as indicated in dotted lines on the chart, a meter reading of 37 is 44 deg. dwell.

For an even closer dwell indication multiply the meter reading by 2, which gives percentage dwell, then multiply by 45 deg. for 8-cylinder cars, 60 deg. for 6 cylinders and 90 deg. for 4 cylinders.



You'll want to make a copy of this chart to cement to the face of your meter. With it you can read dwell degrees directly. You can even mark it permanently with the correct reading



The meter measures the points-closed angle with the aid of a panel-mounted conversion chart. Connect the meter leads to ground and the distributor coil terminal post

For example, in the reading just taken, 0.37 times 2 = 0.74 (or 74 percent dwell time) and 0.74 times 60 deg. = 44.4 deg. dwell.

To check for bouncing points, increase engine r.p.m. A slight decrease in meter reading is normal. But if you get a pronounced decrease, the points are bouncing.

Erratic meter readings mean pitted or burned points and possibly even a worn distributor bearing or a bad cam.

With the engine stopped and points closed, the meter should read full scale. Anything less indicates high contact resistance or pitted and burned contacts.

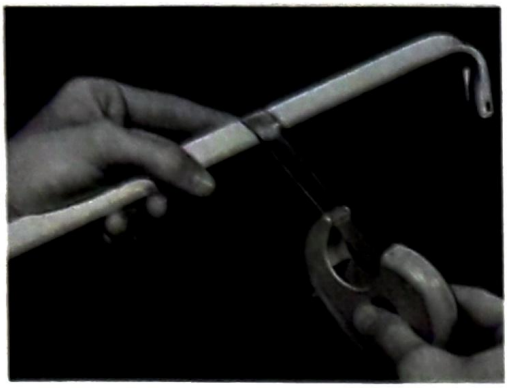
A shorted condenser is indicated by a full-scale reading with the points open.

Anytime you can't get a full-scale reading in the CAL-SET switch positions it is time for new batteries.

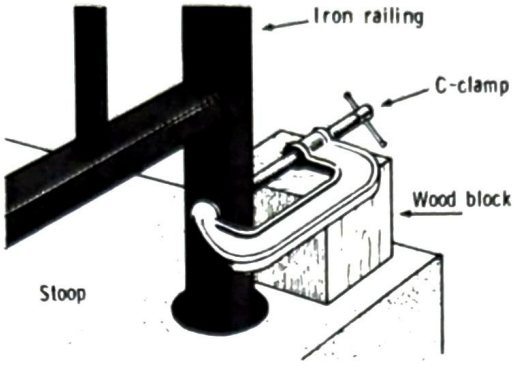
PARTS LIST

1—Resistor, 15,000 ohms, ½ watt, carbon
1—Resistor, 22 ohms, ½ watt, carbon
1—Potentiometer, 5000 ohms, Lafayette VC-33
1—Capacitor, .015 MFD 600, volts, Centralab DD163
1—Rectifier, silicon diode type 2E4
1—Meter, 50 microamps, Lafayette TM-200
2—Slide switches, dpdt, Wirt G-126
1—Battery box, Keystone 156
3—Batteries, penlight, 1½ volts
2—Insulators, Meuller 47
2—Test clips, Meuller 45
5-ft. lamp cord
Panel, 6¼ x 3¾, Lafayette MS-217
Case, Bakelite, 6¼ x 3¾ x 2 in., Lafayette MS-216

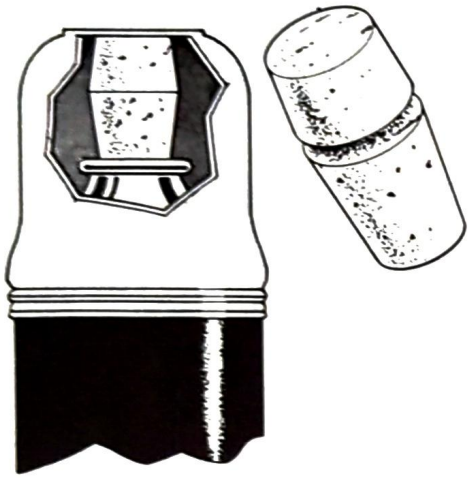
See also: electrical system, auto; ignition system, auto.



To prevent curtains from catching and tearing on curtain rod joints, wrap the joints with cellophane tape.

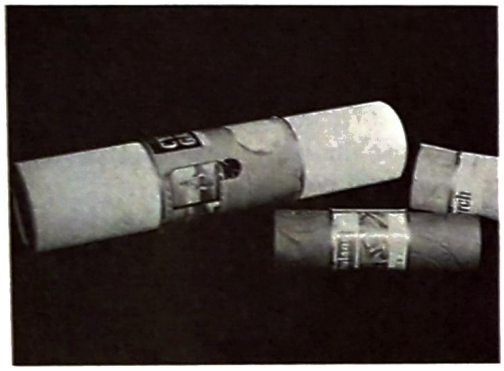


A C-clamp propped on a wooden block will support an ornamental iron railing at the right height while molten lead is poured around the base.

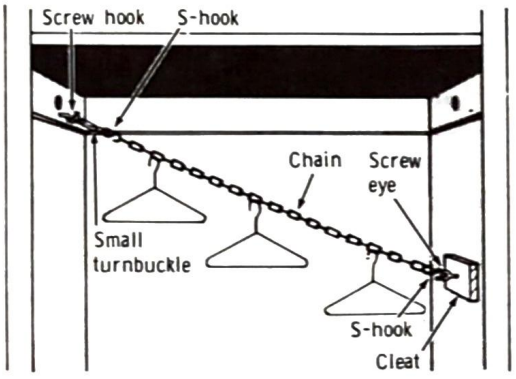


Glue a second piece of cork to the cork stopper of your Thermos bottle. Then when the top is screwed on it will prevent the stopper from loosening.

An excellent way to insulate your favorite cold beverage is to wrap the glass in aluminum foil.



Cut the ends from tin cans to make storage sleeves for holding rolled materials.



A chain substitute for that pole in your closet permits kids of all ages to hang their clothes.

Best check is looking through the back of the camera and through the lens as you set the aperture and shutter at each of their settings to test for consistency

Ten basic checks,
in the store and at home,
will spot quality trade-ins
on the dealer's shelf

How to buy a good used camera

BY C. H. CRANDALL

MANY PHOTO STORES have genuine bargains on their used-camera shelves. And a used camera is not necessarily an abused camera. However, buying any used precision instrument involves a certain amount of risk, so the wary buyer can minimize the risk by applying a few simple checks, some in the store and some at home during the customary trial period.

Before even going to shop, however, decide what you want the camera for—black-and-white prints, color prints or color slides—and how much you can spend. The first will help establish the size. The 35-mm. camera is certainly the most popular for color slides, and the 35-mm. and 2¼-square cameras are the most common for all-around work. Whether you want a range-finder (with which you focus through a special viewer) or a reflex (with which you focus through either the actual lens or a duplicate of it) is a matter of personal choice.

1. *Check the appearance.* It has some bearing on previous use, but a shabby-looking camera can still be functionally sound. However, severe dents may mean the camera has been dropped, jarring the mechanisms. Corrosion may extend to working parts. An accumulation of dirt and debris or scratches may mean severe misuse. Burred screw heads indicate an amateur mechanic has been meddling.

2. *Open the back.* The working parts are all

camper: see pick-up camper
camper boat: see pram
camper cabana: see cabanas

Open the back of the camera and examine the inside. The pressure plate should be firm though not stiff, rollers should spin easily and the interior should be reasonably clean. The inside appearance is actually more important than the outside

Roll some film through the camera to test the winding mechanism, both with the back open and closed. If the film comes out with wrinkled edges, it is not winding properly and could cause fogged edges on your negatives

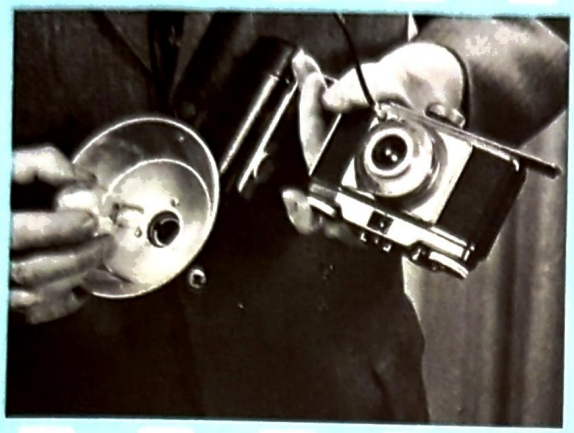
Remove the lens on a camera with interchangeable lenses and examine separately for dents and scratches. Replace and remove it several times to check snugness of fit. A poor fit could cause light leaks or focusing problems

A built-in meter can be checked against a name-brand meter. Camera meters are usually much smaller and less sensitive than hand-held meters, but the readings obtained should be within one-half stop or so to be of any effective use

inside and your most important checks will be made there. A clean inside is a good sign, no matter how shopworn the outside. Twirl the rollers and test the pressure plate (see photo). Both are important for proper feeding of film.

3. *Look through lens* with shutter on "bulb" to open the lens. Then hold it toward a light and look through it for nicks, scratches, discoloration or disfiguration. (Ignore small air bubbles you'll find on most lenses.) While it's open, move the lens' aperture to each of its f-stops. The iris blades should move in unison and form a symmetrical opening (usually hexagonal) at each stop, and each opening should be half (or double) the size of the one next to it.

4. *Next,* with the aperture wide open, close



Built-in attachments can be tested in the store. Flash units, either bulb or strobe, can be fired at the counter. To check synchronization, look through the lens through the back of the camera to see if the flash fires when the shutter is open

Cameras with bellows need a special check. A small penlight should be inserted inside the bellows to check for light leaks. Even one small pinhole could fog every picture. Also check the bellows' adherence to the body and the lens board

used cameras, continued

the shutter and run a similar test. With the camera toward the light, cock and fire the shutter at each of its speeds, up and down the scale. It should look and sound consistently faster (or slower) than each previous setting. Repeat the test.

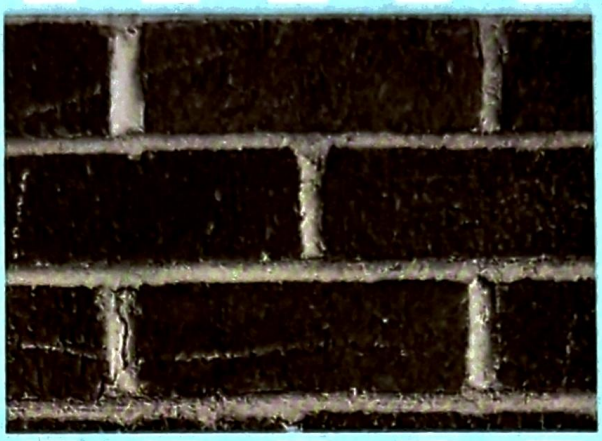
If the blades on either the iris or shutter stick, or in severe cases flop loose, move on to the next camera. The advantage of these through-the-back checks are that you check the lens, the aperture and shutter—the three most important parts of the camera—as well as the cocking and shutter-release mechanisms.

5. *Remove the lens.* If the camera has interchangeable lenses, the aperture and shutter tests outlined above can be done separately. Also, by removing the lens you can examine it for burred threads or for nicks in the mount or scratches on the glass. Shake it and listen for loose elements or bits of glass. When replacing, check snugness.

6. *Run film through the camera.* Bring or buy a roll of outdated film and load it in the camera. With the back still open, run it through once, cocking and firing the shutter and advancing the film one frame at a time. It should ride over the rollers (or sprockets) easily. Rewind it and, with the back closed this time, run it through again.

The camera lens is perhaps the most important—and expensive—item on a camera. The working mechanism can be repaired, but a scratched lens can be practically useless. The tiny bubbles found in most lenses are harmless

Take some pictures. This is the most practical test of all, because it's what the camera is for. Take a few closeup portraits and long-shot scenics, and make prints to check the results for sharpness



Brick walls or any other flat, detailed surface can be used for testing the sharpness of a lens on a plane, from corner to corner of the frame. These tests should be made with a tripod to eliminate any camera movement

If there is any problem about the film riding up over the grooves it is meant to run in, or winding sloppily, film may tear.

7. *Check the accessories.* Some cameras have built-in accessories or attachments and, since they are part of the purchase price, they should be tested, too. Flash attachments are quite common, and can be tested readily in the store by borrowing or buying a few bulbs and firing them. If the camera is synchronized for electronic flash, borrow a strobe unit (or bring your own) and test-fire that, too. Built-in exposure meters can easily be tested against another meter.

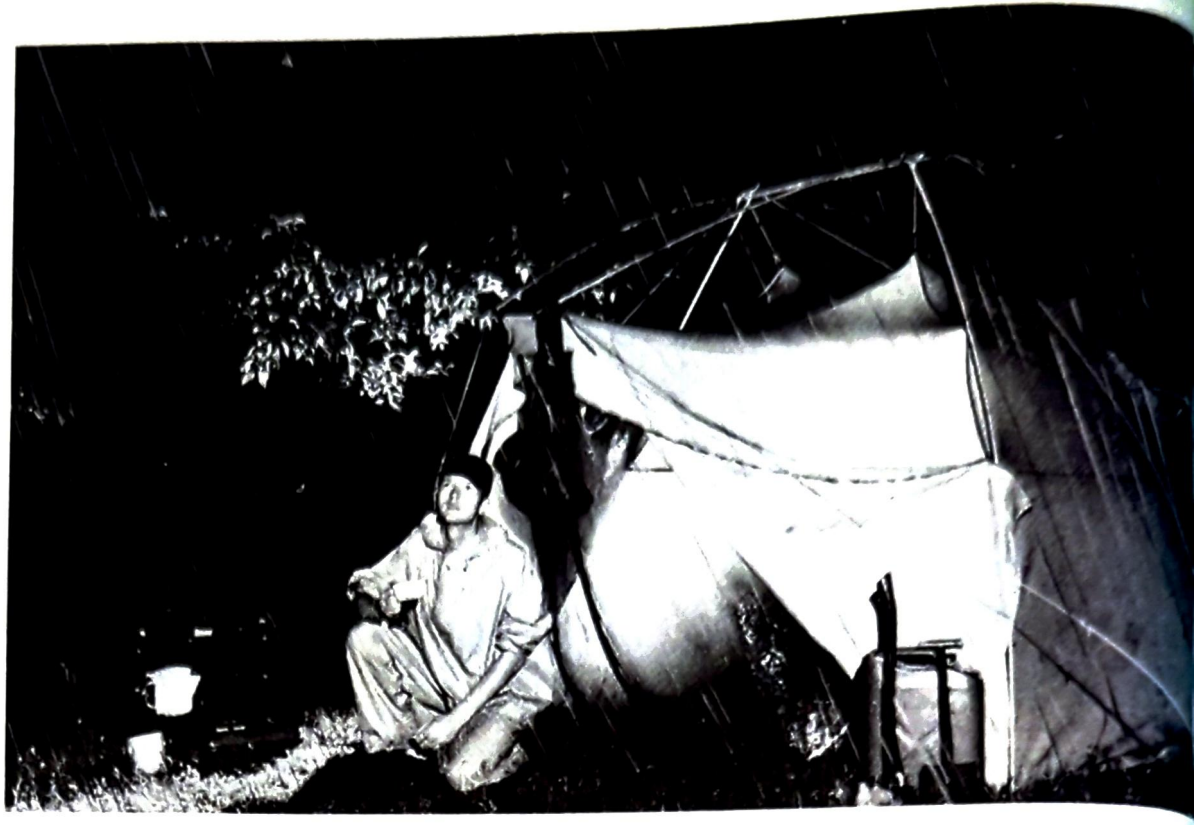
8. *Check the focus.* This is especially important on rangefinder cameras, where you depend almost completely on the focusing mechanism for sharp focus. Check it for telltale play. On reflex cameras you depend primarily on your eye. On either, however, it's a good idea to double check both the nearest and farthest ranges of the lens. Most normal lenses will focus down to within 3½ ft. or so. Do it, and measure off the distance carefully with a tape. Then, with the clerk's permission, step out on the street and focus on something distant, at least 100 ft. away. The footage scale on the lens should be on the infinity mark. If both the near and far focus line up accurately with the footage scale, the range in between should be accurate.

9. *Get a trial period.* Most reputable stores will give some form of trial period during which you can take the camera home and actually try it out. The most common is a 10-day trial, which gives you time to test with actual film.

10. *Take pictures.* Use the trial period for some systematic testing especially of the sharpness of the lens and the accuracy of the shutter, plus the intangible of whether you enjoy working with the camera. (Some personal dislikes, not apparent in the store, show up during shooting sessions.) Test the lens by taking closeup portraits as well as pictures of a flat surface with lot of detail, such as brick wall or a newspaper taped to a wall. If possible, use a tripod to eliminate movement, and take pictures at both the widest and smallest apertures. The portraits will tell you how fast the focus falls off from front to rear and the flat-surface pictures will tell you how well it holds up from center to edges. In addition, take scenic long shots to test the lens at infinity.

To test shutter consistency, take a series of pictures of the same subject at all shutter speeds, adjusting the aperture each time to keep the same exposure (i.e., 1/25 at f:22, 1/50 at f:16, 1/100 at f:11, etc.). If the shutter is way off on one of the speeds, it will show up in this series.

See also: flash box, photo; microphotography; photography; testers, photo; tripods; underwater camera cases.



When the weather turns foul, the experienced camper has a few tricks to keep him dry and comfortable

Snug camping in foul weather

BY PAT SNOOK

BAD WEATHER doesn't have to dampen the fun on your camping trip.

While some campers shudder at the sight of a dark cloud and run for home or the nearest motel, the experienced outdoorsman merely adjusts to the prevailing weather and comfortably continues with his outing.

Camping's biggest and most basic attraction is its challenge. With just a few improvisations you can adapt to any weather, adding enjoyment to your trip, whether you pitch your tent in the wilderness or the largest commercial campground.

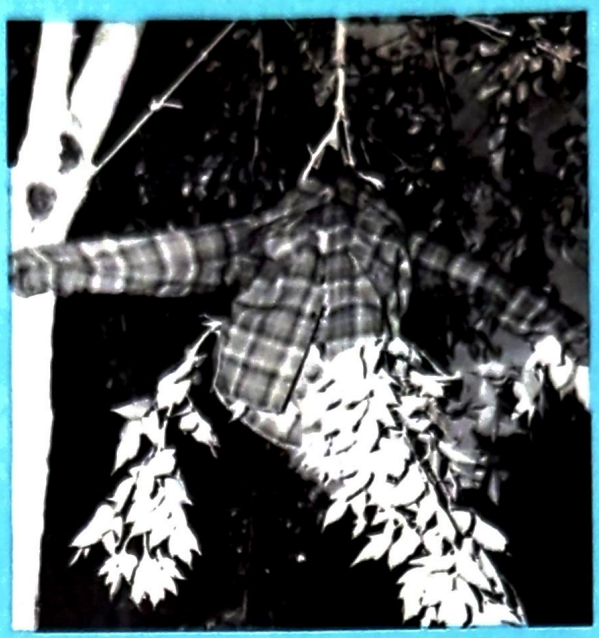
Awakening in the morning to the sound of rain on a tent roof is a wonderful experience—until you remember you have to start a fire and you forgot to stow a supply of dry wood for just such an occasion. If you have some candles—it's a good idea to carry a supply of old stubs—place one in the middle of a "tepee" of small wet twigs. By the time the candle burns down the stack of twigs will have dried .

If the rain is really coming down and you need protection for your fire, look for a good-sized rotten birch tree that has fallen. The pulpy inside is easily removed, leaving a bark cylinder. Build your small fire inside a section of the bark. The kindling will be protected from the rain, and once it gets started the birchbark will burn through and make secondary tinder for the larger fire. Finding dry wood for that larger fire might seem impossible, but there's plenty in a dead (but not rotten) tree that is still standing. What you want is one that gives a solid ring, not a dull thud, when you hit it with your axe. Fell the tree, cut it into fire-length sections. Split away the outside and you will find dry wood inside.

More excellent sources of fire-starting material in any weather are scrub pine and spruce trees. Near the bottom branches, you will find clusters of small dead twigs close to the trunk. The protection of higher branches keeps these twigs dry, and they are loaded with pitch, which makes them burn hot enough to get even the most difficult fire going.

Wet feet can take the pleasure out of any camping trip if you have sustained rain. If the soggy ground is getting the best of your boots,

Wet and muddy boots will make a mess of a tent floor, but campers can easily avoid this problem by slipping plastic bags over the boots when they come inside. The bags can also be used as boot liners



Damp clothing will dry faster if leafy branches are stuck in the arms or legs. Button the garment around a large branch and hang up in a tree. The leaves allow the air to circulate freely through the clothes

try using lightweight plastic bags as boot liners. Put the bags over, not under, your socks. There will be a problem of moisture condensation, because these bags do not "breathe," but you can solve this with heavy wool socks.

Tracking mud into the tent can be eliminated by wearing the plastic bags over your boots, tied at the ankle with a piece of string. When you leave the tent you remove the bags; put them on again when you return.

Drying out a pair of wet boots can take a full day in the sun or next to the fire. You can cut this time to a half hour by heating a skillet of sand or gravel and pouring it into the boot. Heat a second batch while the first is absorbing moisture and keep repeating the process.

An ordinary baseball cap should be part of your emergency gear. Worn under the hood of your rain jacket, the bill keeps the rain out of your eyes.

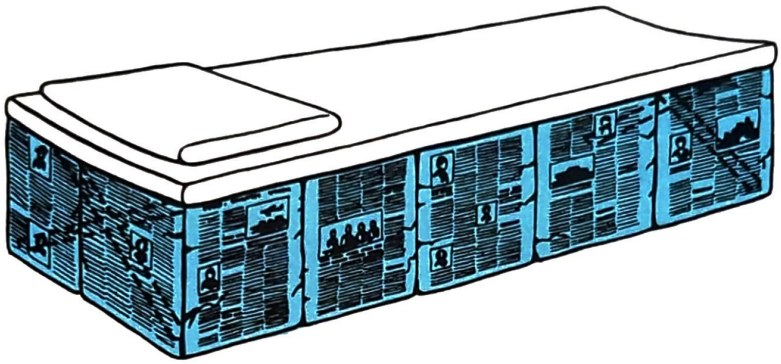
A leaky tent can produce more angry snarls than a bag of wildcats. Carry along a small block of beeswax or paraffin, and if you spring a leak, soften the wax by holding it between your palms for a few minutes, then rub it into the leaking seam, exerting just enough pressure to get it into the fabric. If this doesn't stop the leak, you can divert it to a less troublesome place by running your finger against the fabric from the leak to another spot.

During a siege of wet weather, don't make the mistake of buttoning up your tent too tight. Allow for as much ventilation as possible. If you kill the air circulation the resulting condensation will form droplets on the inside of the tent, and before long everything will be damp and clammy. This also holds true in cold weather, particularly if the tent is heated.

The necessity for proper drainage is one of those things that are taken for granted and no one seems to bother with. It is discouraging for a camper to wake up in the middle of the night and learn that he pitched his tent in a dry creek bed that has blossomed into a gurgling brook. This grief can be avoided by carefully selecting a tent site on reasonably high ground, and properly trenching around the tent. A trench should be dug several inches from the tent walls, and

Radiant heat can be reflected into a tent during a cold spell by burning a small stove in front of a sheet of aluminum foil draped over an A-frame of sticks. A reflector behind an open fire is also good

To hold the tent guy lines in sand or soft ground, use a dead man's anchor. Lash two sticks together into a cross, attach the guy line, and bury in a shallow hole. A pie plate with a hole in the center can serve, too



A camp cot can be made warmer and more comfortable if drafts and ground damp are blocked by dead air space under the cot. The space is created by hanging newspapers or light plastic sheets over the sides and ends of the bed

snug camping, continued

should have a "V" shape for good run-off. A small spade or Army surplus trenching tool is ideal for the job but a spatula or an empty can will do the trick.

A thick bed of pine needles under the tent floor and in the surrounding area will act like a storm drain in wet weather. It not only absorbs water like a sponge, but also gives you a soft cushion under your tent floor and a camp area free of mud.

Once the rain stops there will be wet clothes to dry. To hasten the process, cut off a bunch of small, leafy branches and stuff the clothes with them before they're hung up to dry. A branch stuffed in each leg of a pair of trousers or through the sleeves of a shirt before the garment is wrapped around a larger branch will allow air

Nothing is quite as miserable as wet boots. One cure is to dry the boots with hot sand or gravel. Heat the material in a skillet over the fire or stove and pour it into the boot. Repeat until the boots dry

When available kindling is wet, a fire can always be started with the small dead twigs found low on the trunks of pine and spruce trees. These burn hot because they are loaded with pitch

to circulate freely and cut the drying time in half.

Pieces of old inner tube can protect your tent from being blown down in a strong wind. An elastic loop tied into the middle of each guy line will act as a shock absorber for strong gusts of wind. When the tent is pitched, take up on the slides only enough to slightly stretch the elastic link, leaving enough give to absorb any extreme tension from the gusts.

The guy lines to the main support poles are designed to exert a pull equal to the weight of the tent. The added force of the wind can create an unbalance and result in split seams. Several extra lines, rigged in different directions from each pole will absorb the additional pressure. There should be enough slack so the lines—not the tent—take the stress.

Few tent stakes will hold well in soft ground or sand. An effective device for these conditions is the *dead man's anchor,* two sticks lashed together to form a cross and buried in a shallow hole. The guy lines are tied to the center of the cross. An even more effective anchor can be fashioned from a tin pie plate by making a hole in the center and attaching the line. With either rig, the anchor is placed at a 90-deg. angle to the line.

Extreme heat can turn a tent into an oven. An old blanket draped over the tent and wet down with water is a fairly efficient air conditioner. If the temperature goes the other way and you're suffering from cold feet at night, pull a large packsack over the bottom of your sleeping bag. It is not an electric blanket, but it helps.

On a cold night there is nothing more uncomfortable than a folding camp cot. The body compresses the insulating fibers of a sleeping bag, and although you may be warm on top, you'll be freezing underneath. To keep out drafts and cold seeping up from the ground, you must create a protective air pocket beneath the cot. A bunch of old newspapers will do the trick. With one edge tucked under the bag, let them drape over the sides and ends of the cot to create the air pocket.

The inexpensive plastic sheets sold in most hardware stores for use as painter's drop cloths have a hundred uses in a camp during bad weather. They take up little space, and are quite light—so packing them is no problem. They can serve as ground cloths or light tarps for your food and gear; they can be wrapped around anything that requires protection; they can even be used as emergency rain covers for the campers.

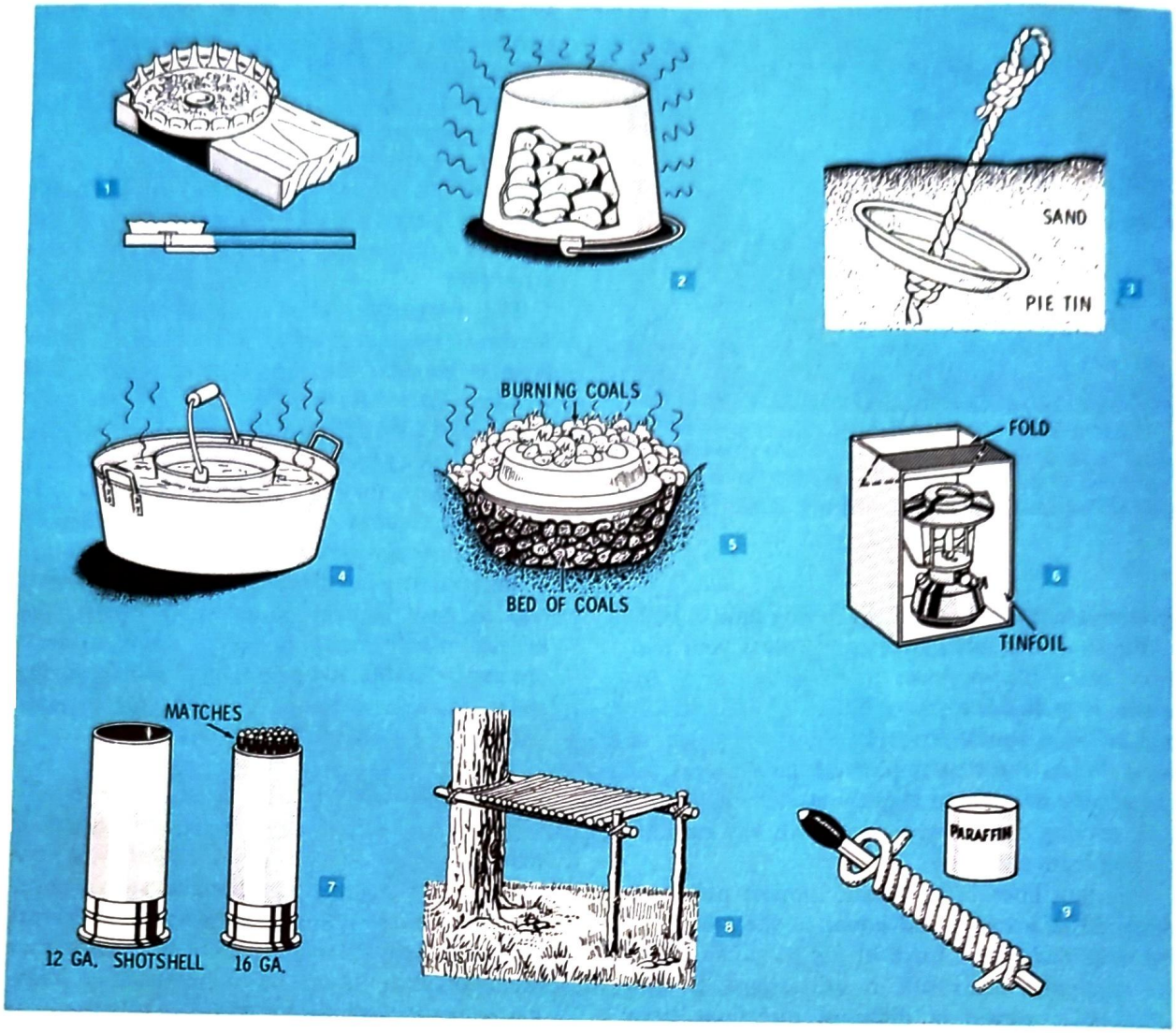
Because they are light, they are subject to wind and to easy damage from heavy boots. The heavier plastics used on construction projects are more durable, but also require more packing space. Perhaps a couple of each type in your emergency kit offers the best answer.

use stove as heater

Your gasoline stove can double as a heater if the temperature drops unexpectedly. If you have the two or three-burner gasoline stove, cover the inside of the lid and the side wind deflectors with aluminum foil and fire it up. A single-burner mountain stove takes a bit more ingenuity. Fashion some sticks into an A-frame to support a curved sheet of aluminum foil, and place the stove directly before it, allowing the heat to reflect. An open fire at the tent opening with the A-frame reflector behind it will do the same job, and if it is not too cold, a camp lantern before the reflector will give off considerable warmth. In every case it is important to keep the heater away from anything flammable and allow plenty of ventilation.

Bad weather is seldom a deterrent to the avid camper; it merely sharpens his natural abilities to take the outdoors as it comes. With the exception of the cave and the grass hut, the tent is the most ancient shelter known to man, going back in history more than 5000 years. It is still as good as it ever was, and any experienced camper can make it a comfortable home even in bad weather.

See also: boat camping; boots; cabanas; clothing; packs, camping; pick-up camper; pram; shelters, camping; sleeping bags; tents; trailers; wild foods.



Kinks for campers

1 Scaling a fish without proper tools for the job is easily accomplished by nailing a common bottle cap to a stick about 12 in. long. Bend the nail over the back of the stick.

2 When the temperature drops unexpectedly, you can improvise a heater for your tent by placing a number of medium-size stones in your fire until they get hot, and then putting them under an inverted bucket.

3 Pitching a tent on sand or loose ground where regular stakes will not hold is possible with guy lines anchored to heavy foil pie plates. Punch a hole through the center and knot the line on the other side.

4 For mixing beeswax with turpentine to make a waterproofing agent for your tent, melt the wax on a stove, then add it to the turpentine in a bucket standing in a tub of hot water. This prevents open flames.

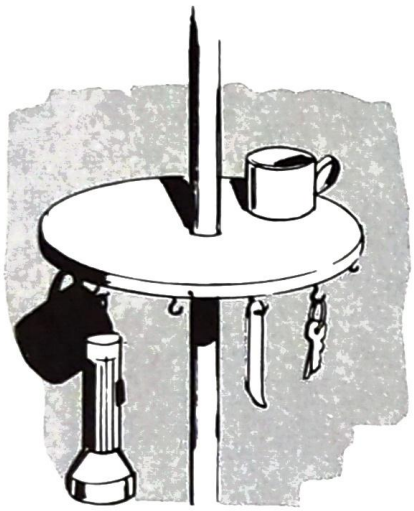
5 A small, but effective, oven can be improvised by placing two pie tins face to face and burying them in a bed of hot coals. The space is deep enough for small fish, soda biscuits, etc.

6 A gasoline lantern and a cardboard carton make an excellent heater. Stand the carton on end. Cut half of the top away from the back and fold down to make a deflector. Line the inside with aluminum foil.

7 Keeping a reserve of dry matches is a wise move for any camper. A waterproof container that will float can be fashioned from two used shot shells of different sizes, one to hold the matches and one to serve as a cover.

8 A camp table is easily built with dry branches. Drive two stakes about four feet from a large tree, then tie cross pieces to the stakes and attach them to the tree for rigidity.

9 Fire starters that burn with intense heat come in handy when firewood is damp. Wrap a kitchen match with yarn, tie it off, and dip it in paraffin. Chip the wax off the end when you are ready to strike the match.



Work-savers for campers

Campers are an ingenious lot. Dedicated to living outdoors as comfortably as possible with very little equipment, they become masters of improvisation, getting double and triple duty out of everything they use. Here are a few ideas that veteran campers share among themselves.

The couple in the top picture has solved the camp furniture problem simply by bringing along aluminum outdoor furniture. Lightweight, durable and collapsible, it gives them a campful of good furniture without adding much to their load.

Some campers object to center tent poles, but one of them wouldn't be without one. He drilled a hole the same diameter as the pole in a circle of plywood and holds it table-high with a peg through the pole. It makes a great little table. Another camper used a similar idea, but made his table bigger, carried it in two halves which he clamped around the pole

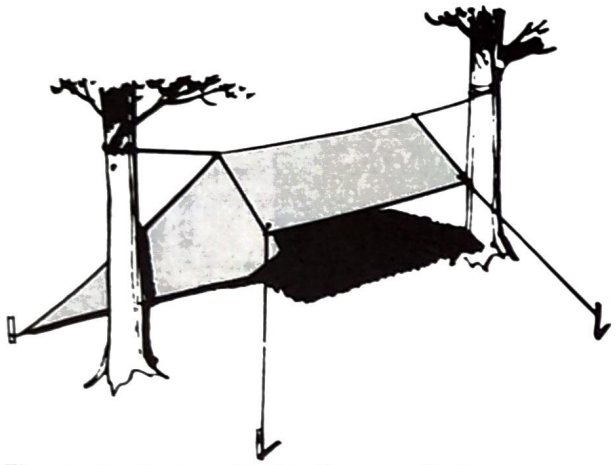
Lost and found insurance for camping kids: Give each one a dime-store whistle on a string around the neck. They should blow it when called or separated

Save an old tree fork if you don't have a chopping block. A log braced in it as shown is easy to split and stays put. Start splitting near the outer edge and work your way in towards the center

Whether you fell your own timber or take leftovers from a campground firewood pile, you can't beat a camp saw for making fast firewood out of logs. Buy one with "raker" teeth (top), always rig a sawhorse, and let the weight of the saw do most of the work

Another substitute for a chopping block is a level, sawed-off stump. Stand your logs upright and split them inward from the outer edges so that every blow will break off a clean billet. If you hit the center first, you'll only wedge the ax

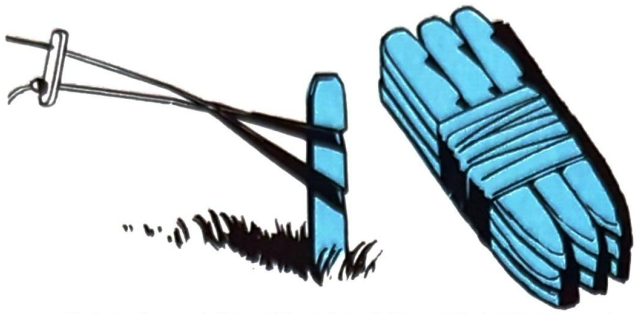
A plastic sheet has a thousand uses at any campsite. It is lightweight and occupies only a small space in the camping gear. One use: dig a hole and cover it with the sheet. Fill it with water and presto, you have a washtub



The plastic sheet again, this time as a tent, a windbreak, a sunshade. Or as a rain cover for gear

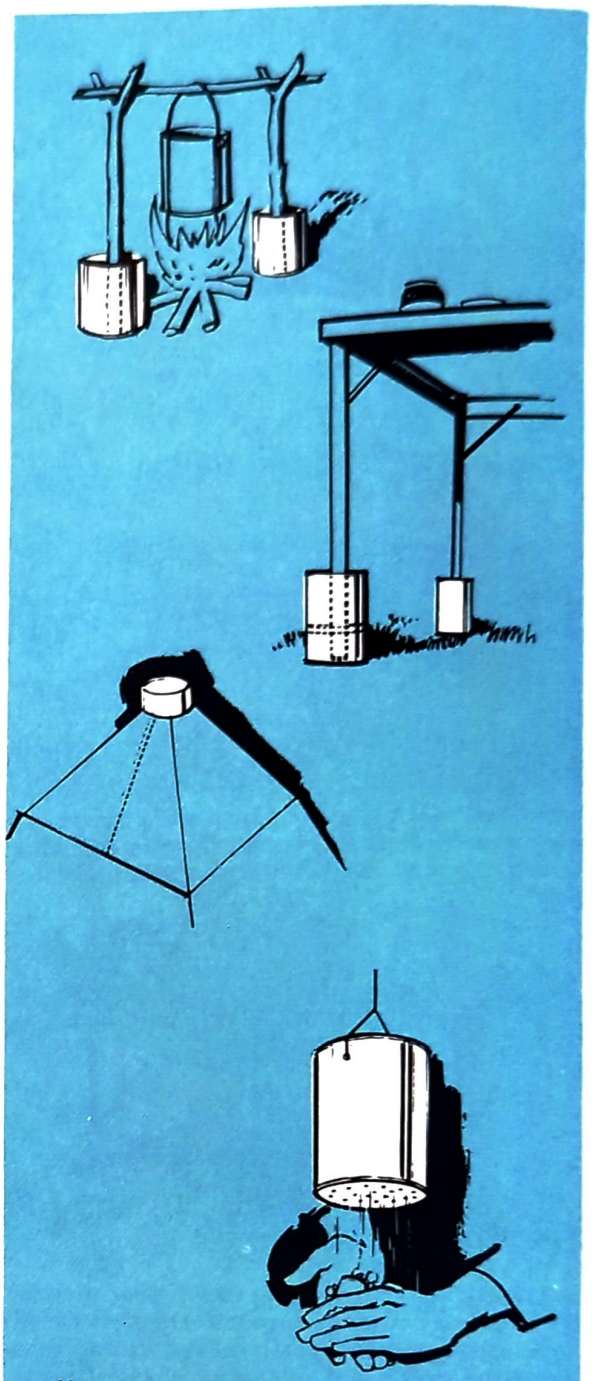
The same sheet makes a fine raincoat or poncho for sudden showers. If you expect to use it as a tent or shelter, buy the heavy duty plastic sheet

Don't kill the grass for one fire. Cut an "H" in the sod with your spade, peel back two rolls of sod as shown, and set up your fire

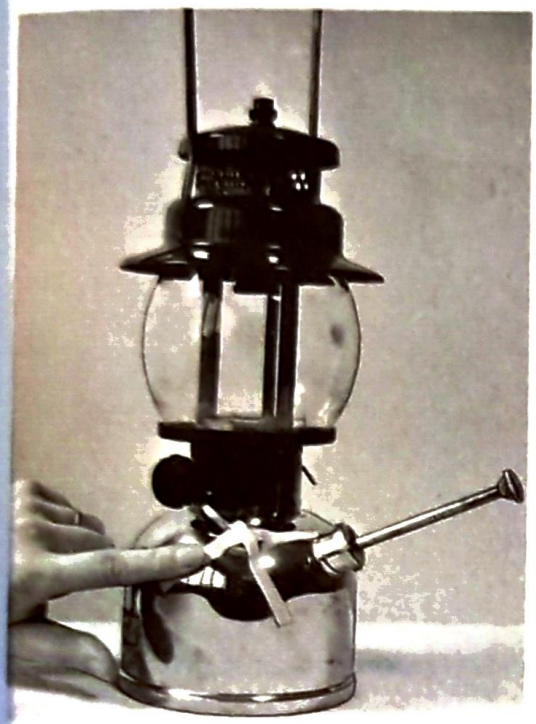


Cut an inner-tube rubber-band for each tent peg and use them to keep the pegs together when traveling. Then use them as shock absorbers by putting them on your tent pegs and running guy ropes through them

Car campers needn't sleep in damp sleeping bags. Stop in the next town and use the dryer in an automatic laundry. The dried bag is lighter, softer and much more comfortable in cold weather



No smart camper throws away all of his tin cans. They sometimes turn out to be worth their weight in gold. Two of them with both ends cut out will protect your firesticks from charring (top). Cut to fit over a tent pole, a can will keep a soaking rain from leaking in. To keep ants and other insects away from the table, put a can under each table leg and put in each an inch or so of water and a little gasoline or oil. And if you find yourself in need of a miniature camp shower that will make handwashing easier—no assistant is necessary to man the pump handle—just punch a number of holes in a good-sized can. One filling lasts long enough



Gasoline lanterns should be cleaned and stored empty, with valves and caps left open. For safe keeping, be sure to tape the cap to the tank

Before storing a camp lantern, apply oil to the pressure pump's leather washer to keep it from shrinking

Pamper your camp gear

BY BOB and WILMA KNOX

Your next trip will be more fun if you store your gear right

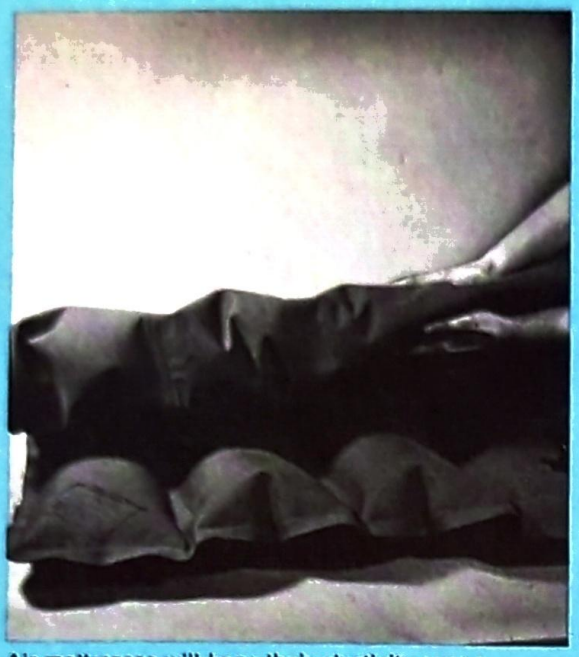
LIKE OTHER CAMPERS, you probably have a small fortune in tents, sleeping bags, picnic jugs and lanterns. But your gear can be worthless if it doesn't get proper care. Tents will be tough to set up if sectional poles are bent and don't fit together. Sleeping bags won't be comfortable if down has sifted out of tears. Hot meals won't happen if your stove won't light.

To prevent such problems, here are a few easy suggestions—based on manufacturers' recommendations—that will keep your gear in top shape and help retain its value.

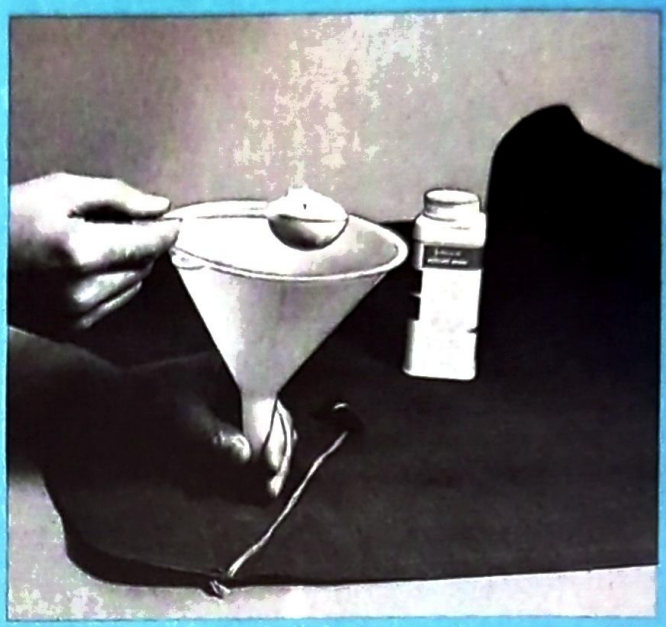
The major recommendation from manufacturers: store gear in a cool, dry place. But even more important, they say, is what you do with gear before you store it away. Before-storage maintenance pays big dividends.

Start with your tent. This is one of the most expensive items a camper buys and as such it merits a spot at the top of the list. Turn it wrong-side out and give it a thorough brushing with a fairly stiff brush after you come in off that last trip. Sand in the floor seams, or thorns and twigs caught in threads of the fabric will wear and weaken the sturdiest of materials.

Examine the tent for dirt spots that won't come out with brushing. These should be removed with mild soap and warm water or, if



Air mattresses will keep their elasticity over a longer storage period if they are slightly inflated and then rolled loosely to prevent any creasing while they are stored away



Sometimes, when space is limited, air mattresses must be stored flat or rolled tightly. In such cases, a tablespoon of talcum sprinkled inside the mattress will keep its sides from sticking

pamper camp gear, continued

particularly stubborn, with cleaning fluid. Next, make any necessary repairs, using adhesive mending tape for small tears and sew-on patches for larger holes.

If your tent has been used for several seasons, or if you've spotted it with soap and water or cleaning fluid, it should be re-coated with water repellent. If this is done *before* storage, the tent should be thoroughly aired and dried before folding to prevent any possibility of spontaneous combustion.

When folding your tent for storage, fold it in a different place each time—a good procedure whenever you take it down. This gives the surface equal wear and helps prevent strain along creases.

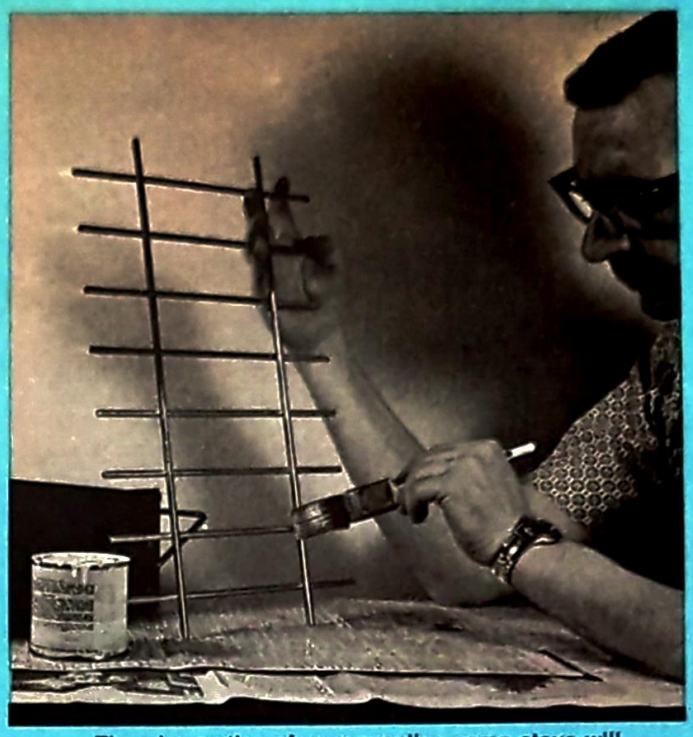
Don't forget the metal poles. These are usually treated to prevent corrosion, but they can be kept in better working order if cleaned and rubbed lightly with petroleum jelly or oil. This is particularly important before a long period of storage. Finally, be sure to store your tent and poles separately; metal flanges and points can puncture the fabric if rolled inside.

Tents will take a certain amount of abuse but sleeping bags, particularly down-filled ones, really *need* pampering. Manufacturers say the first rule in preserving a down bag's life is to keep it so clean it will seldom need dry cleaning or washing. When down becomes soiled it actually loses its loft (fluffiness) and consequently its warmth. But repeated cleaning or washing harms down fibers. The answer is a cotton liner which protects the bag and can be removed for washing.

Eventually, though, your sleeping bag will get dirty. If you decide to have it dry-cleaned, make sure you take it to an establishment that handles such items as down comforters and pillows.

Down bags can also be washed, but this is a

The units of camp-stove burners should be disassembled and thoroughly cleaned before storage. They also should be coated liberally with petroleum jelly to prevent rusting



The wire grating of your gasoline camp stove will have a longer life if it is given a coat of petroleum jelly or aluminum paint before storage. Both burn off when the grating is used

job requiring time, care and patience. Don't use detergents as they have an oil-removing action that injures down. Instead, use a mild, pure soap and warm water. Stubborn spots on the casing can be treated with a solution of 1 part household ammonia and 4 parts of water. Because of its size and bulk, one of the best places to wash a sleeping bag is in the family bathtub. After thorough rinsing, a clean towel will help to remove some of the moisture.

Drying is at best a slow process. It can be done in a commercial dryer at low heat, but the recommended method is putting the bag outdoors in a breeze. Throughout the drying, the down must be fluffed often.

Besides care in cleaning, down bags need care in repairs. Before storage they should be checked carefully for any rips or holes. These should be sewed or patched promptly. Moths won't attack the material normally used for covering, but they do like down and will find holes no matter how small. For the same reason wool liners should never be left inside sleeping bags while they are stored.

Down also deteriorates from oxidation. Vacuum-packed bags have been stored for several years by the Army and retained most of their original loft, while bags left out in the air and light for a similar period will deteriorate. The best bet for yours is to put it loosely in a large plastic bag, or even a box with a lid, and store it away from heat and light. If you don't have much space, keep your sleeping bags in large plastic clothes sacks hung over clothes hangers in a dry closet.

Synthetic-filled bags require about the same care as down bags in cleaning, repairs and storage. They can be dry-cleaned by a reputable cleaner. Some can be washed in your home machine (check the label for instructions), but

Sleeping-bag storage should involve draping the bag over a hanger, covering it with a plastic garment bag and hanging everything in a dry, dark closet

When you fold your tent for storage, crease it in a different place each time. This gives the surface equal wear and prevents strain lines

– ·mper camp gear, continued

take care to use a low temperature and speed, and a low temperature later in the dryer.

The sleeping bag's companion, the air mattress, also takes some care in maintenance and storage. Did you ever squeeze the air out of a mattress and wonder about the white powder that comes out the vent? This is talcum powder put in your mattress to keep the sides from sticking together. If you plan to store your mattress flat or rolled, check to make sure it has been talcum-treated. The best storage method is to keep the mattress slightly inflated, but this requires plenty of room.

By comparison with other camping equipment, insulated jugs and chests require little maintenance and preparation for storage. Just clean with water and a light soda solution, and dry thoroughly. Then open the spigot, unscrew the cap or prop the lid open to allow air circulation. This insures a clean container when camping time rolls around again.

One of the most startling things manufacturers say about camping equipment storage is that white gasoline used for stoves and lanterns can "spoil." For this reason, and because full tanks are storage hazards, pressure-type gasoline stoves and lanterns should have their tanks emptied. Otherwise, fuel tubes and generators can be clogged with residues. Remove tank caps and open the valves wide to allow air circulation. Just to be on the safe side, dispose of any extra supply of gas and start completely fresh in the spring.

Even the wire grate of your stove can be given a longer life by brushing with petroleum jelly or coating with aluminum paint before putting the stove away. The jelly or paint will burn off on the next use. Fall is the time, too—as we remembered in our supper-less camp—to check all working parts and replace defective ones.

Care of a gasoline lantern is essentially the same as for a stove. Make sure the tank is empty, valves and caps open. Check operating parts, and replace if needed. Pump leathers of both lantern and stove should be protected from shrinking by applying a good grade of neat's-foot oil.

Once the before-storage maintenance is completed, you come to that last step: finding a "cool, dry, dark place" for storage. Usually this isn't much of a problem for homeowners, but apartment dwellers often have to be more ingenious. You might solve your problem by using your pick-up camper unit as a storage closet for camping gear in the off-season.

Basement lockers frequently provide space in apartment houses, or you may be able to use part of a large clothes closet.

But no matter what type of space you set aside, remember the most important step in storing your equipment comes *before* storage. Clean, well-maintained camp gear is twice as much fun to use and you'll find it lasts twice as long.

Make an oil-can opener and resealer from strap iron. Insert and solder cut-down 60d nails with sharpened points in holes drilled in the ends of the iron.

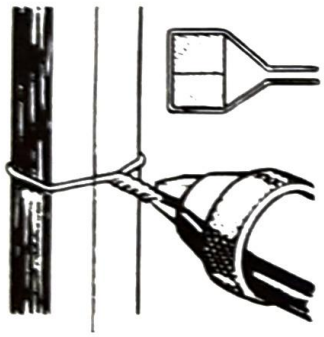
Keep your ladder "well shod." A pair of old tennis shoes stop the feet from slipping.

A spring paper clamp bolted to the outside of your mailbox keeps mail ready for the postman to pick up.

Tape wrapped around chaise longue springs prevents the pads from catching and tearing.

When your open-end wrench is too big, insert a washer to "adjust" the jaw for a snug fit.

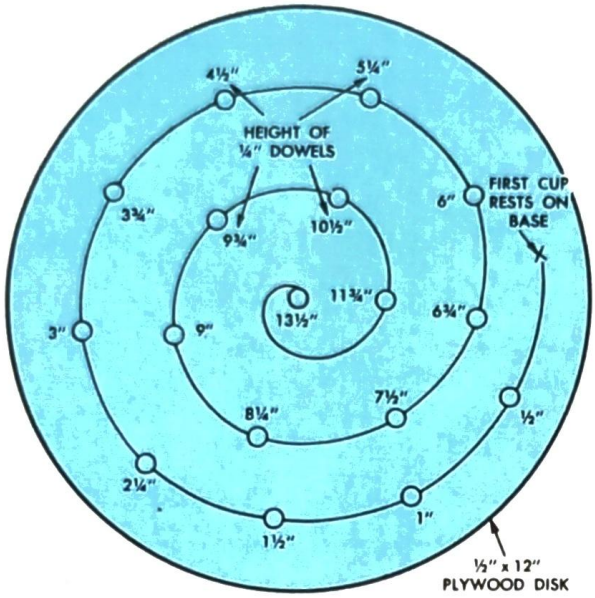
For less back-up and faster funneling, solder three ¼-in. metal strips across the spout joint. This provides a vent to let air escape.

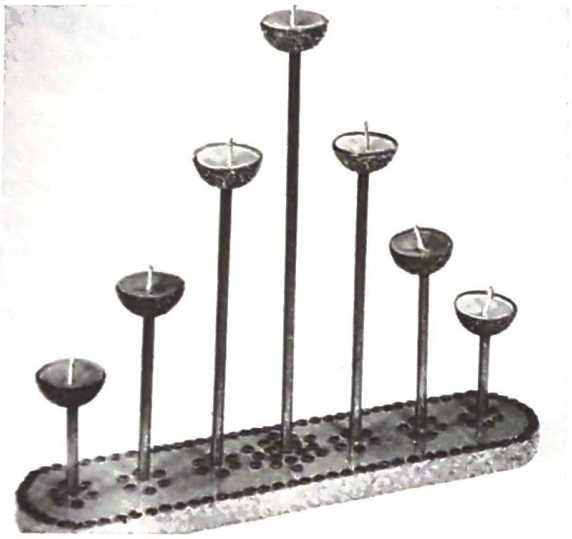


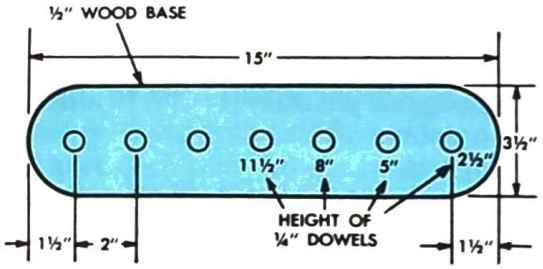
Your hand brace doubles as a good wire twister. Just tighten the chuck around the ends of the wires.

Prevent downspout erosion with a discarded auto wheel sunk flush with the ground. Fill it with coarse gravel.

Hold short boards for edge-planing with wood cleats nailed about ¾ in. apart on your sawhorse. Blocks nailed at the slot ends serve as stop-blocks.







Candle cups

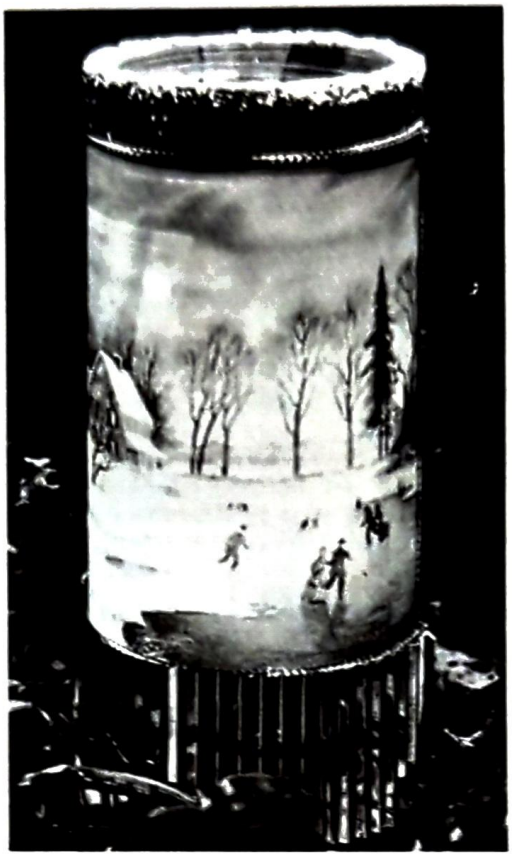
BY THEODOSIA CARPENTER

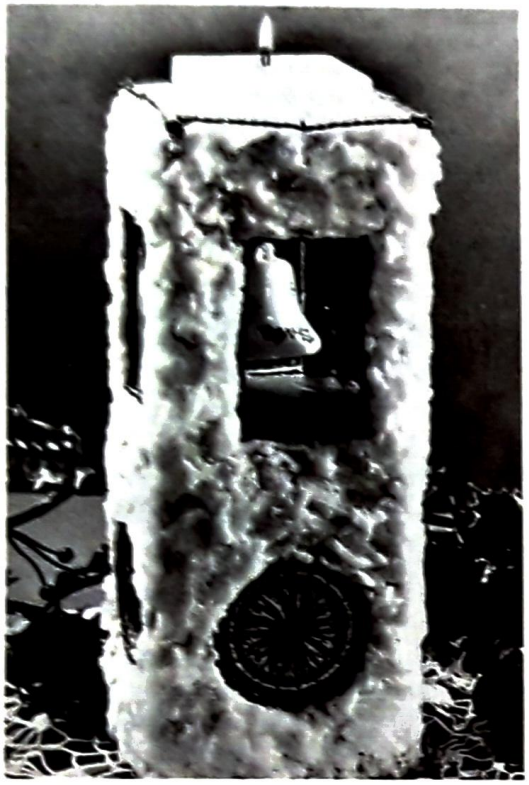
ELEGANT CANDLELIGHT glows softly from these novel candelabra centerpieces. One consists of 18 tapers arranged in an ascending spiral; the other has seven tapers of graduated height.

Candles for both candelabra are molded from plastic refrigerator egg cartons. Buy 12-compartment cartons; use one as the mold and cut the cups from the others. In making the spiral candelabra, attach the cups to the ends of ¼-in. dowels with small screws. Glue the dowels into the holes drilled in the circular base.

Melt old candles and pour the wax into the egg-cup molds. Just as the wax begins to harden, place the wicks. When firm, remove the candles and slip them into the candelabra cups.

See also: bottles, plastic; candles; candlestick.





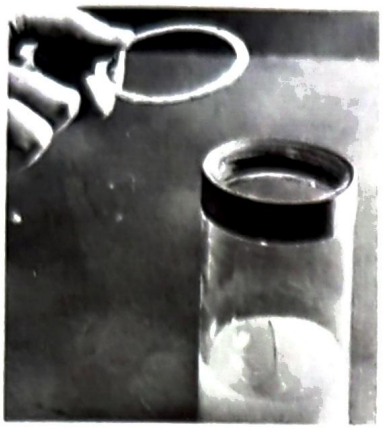
Handsome gift candles

BY WILLARD and ELMA WALTNER

NEXT TO THE TREE itself, the most traditional item in Christmas décor is the candle. When electricity—and prudence—banished candles from Christmas trees long ago, most families were reluctant to give up the cheery glow entirely. And so, through the years, massive sideboard and centerpiece candles have become favorite decorations of the Yule season. They have gained so much popularity, in fact, that they make ideal gifts—except for the price-tag.

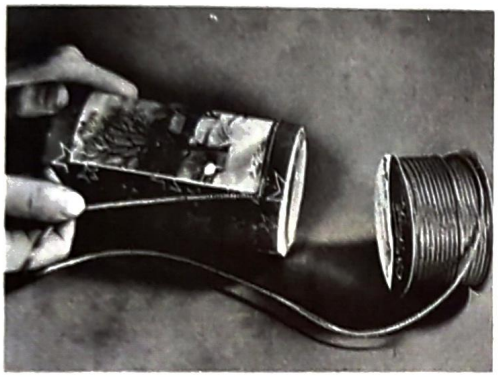
But what could make a more appropriate gift than a personalized candle that you made yourself? If the idea appeals to you, turn the page and learn how the two creations above were made. Once you start thinking about making gift candles, you'll get design ideas of your own.

For the illuminated-picture candle, you'll need a wax with a low melting point (specially made for pouring in glass containers) and some wire-core wicking. This combination lets the candle flame burn all the way to the base instead of drowning in a well of hot wax. The bell tower requires glo-type wax for the replaceable candle block and the "frosting" that coats the tower.



Pour the jar ⅓ full of melted wax. Slip a cardboard collar over the threaded neck to bring it flush with the shoulder; glue on the cardboard rim to cover the rim of the jar

Choose a picture from a Christmas card and glue it to the edges of the jar. It probably won't be exactly the right size, so mask off the rest of the jar with fancy opaque paper



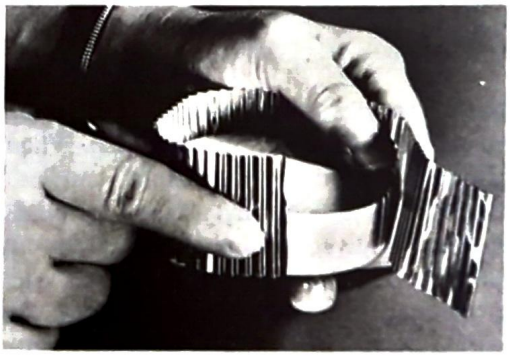
Frame the picture and conceal the butting edges by gluing on some gift-wrap braid. You may not need it along the bottom if the foil strip (below, right) will mask it off

Spread glue on the rim and roll it in gold glitter that is heaped on waxed paper. The wet glue will pick up a coat of these particles, which are sold at card and art-supply stores

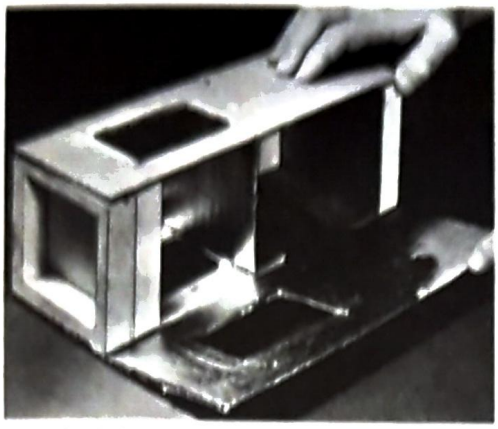
ILLUMINATED PICTURE

To make this candle you'll need a cylindrical jar, without taper, 5½ to 6 in. tall and about 3 in. in diameter. If the jar is too tall in relation to its diameter, the candle won't burn well.

Thread wire-core wicking into a metal wicking base and wrap the free end around a pencil laid across the mouth of the jar so the wicking base just touches the bottom. Bend a pouring lip in the rim of a clean tin can, shave wax into the can and set it in a pan of hot water over a low flame. When the poured wax hardens, clip the wick ½ in. above the wax level. To make the picture translucent, rub it with a dab of cotton dipped in cooking oil.

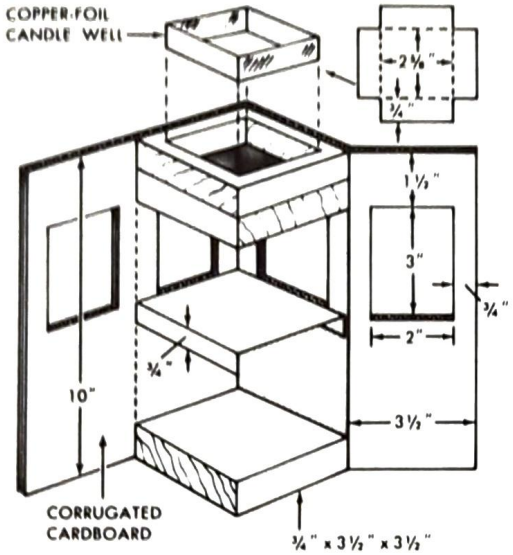


Glue a strip of foil around the edge of a ¾-in. pine disc that is cut to the jar's outside diameter and equipped with three wooden feet. Glue the jar's bottom to the top of the disc

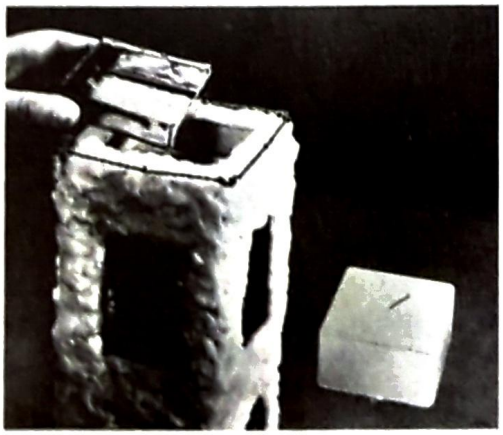


Fold the bell tower's form from corrugated cardboard that is scored with a dull knife to make sharp bends. Brush gold paint on the exposed interior areas before gluing around the end blocks and the cardboard belfry floor

Frost the tower with beaten wax, using a knife blade to dabble the wax over the cardboard. Work carefully around the openings, decorations and candle cavity. If the wax gets hard and won't stick, remelt it and beat it again



Glue the gift-wrap braid inside the edges of openings and around the tower's decorations after the wax frosting has set

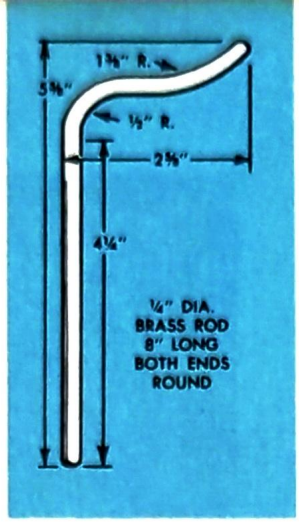


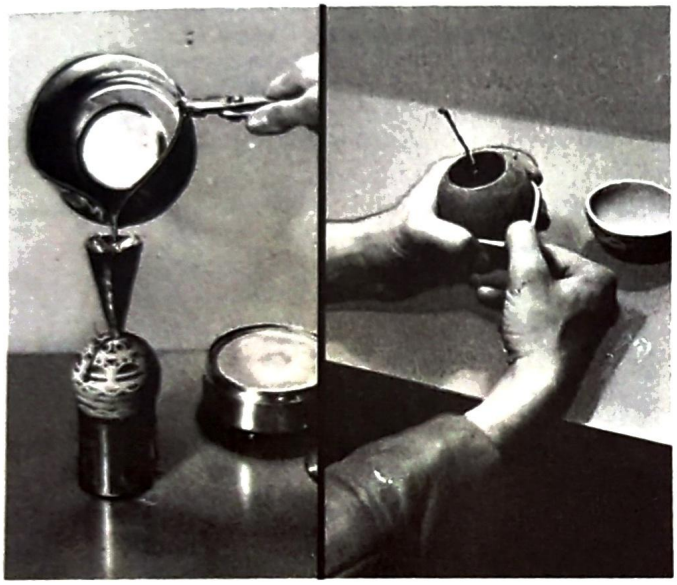
The foil candle pan fits inside the well of the top block. From a block of candle wax, cut a piece to fit into the holder

BELL TOWER

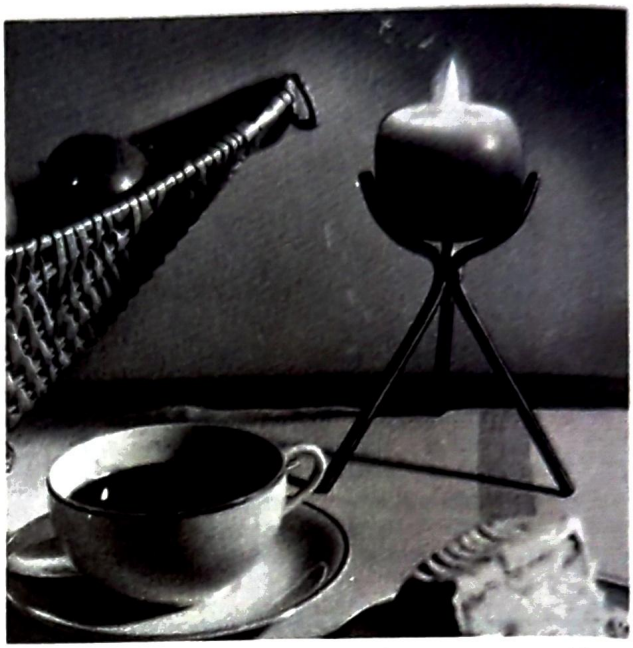
Though the wax frosting makes it look like a candle, the tower is really a holder you can save for reuse. The replaceable candle nests in a recess at the top. It's a block of wax with a wick through its center. Fold masking tape around the edges of the belfry openings before gilding the inside surfaces. Then paste on round motifs cut from Christmas cards. For frosting, shave candle wax into a can set in a pot of water over low heat. Let the melted wax cool until a thick skin forms over the surface, then whip it with an egg beater until it froths. Hang a small ceramic bell from a screw-eye turned into the bottom face of the second block.

See also: candle holders; candlestick.





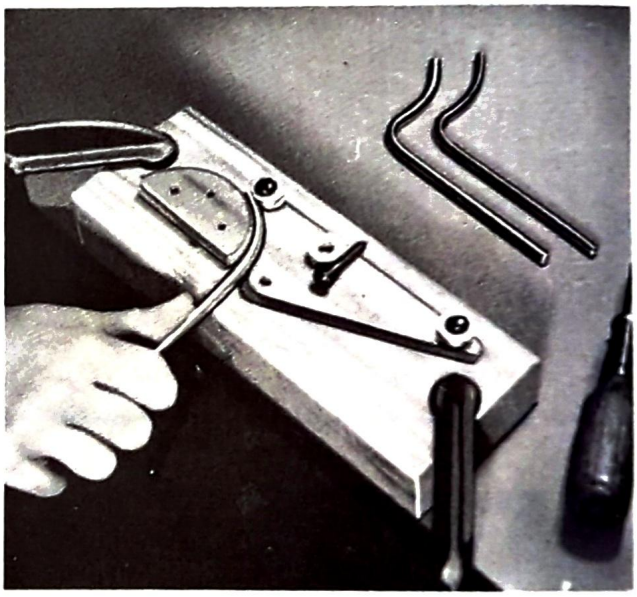
Prop the ball in a tin can when filling. Use a funnel of aluminum foil to fill the ball (left). After the wax is hard, peel off the ball, being careful not to scratch the wax. Scrape the surface smooth and polish with a soft cloth



This simple, elegant candle will look great on any table in your home. Legs of the holder are of gleaming brass. As the flame burns in a recess, the candle gives off a pleasant glow, even more striking when colored wax is used

Danish candle

BY ROBERT MICALS

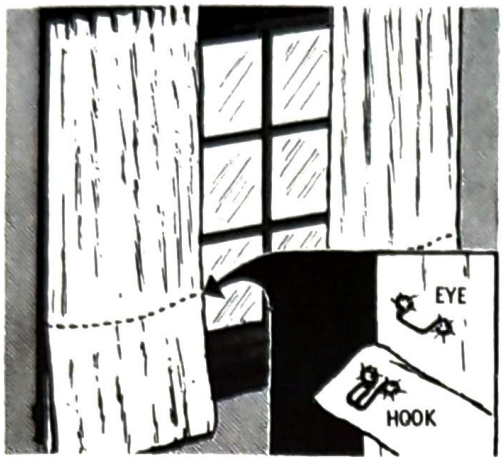


The bending jig for making the tripod legs consists of a 2 x 4, 10 in. long, to which are attached a half disc of plywood having a radius of 1⅜ in., and three stops, each consisting of washers held by screws

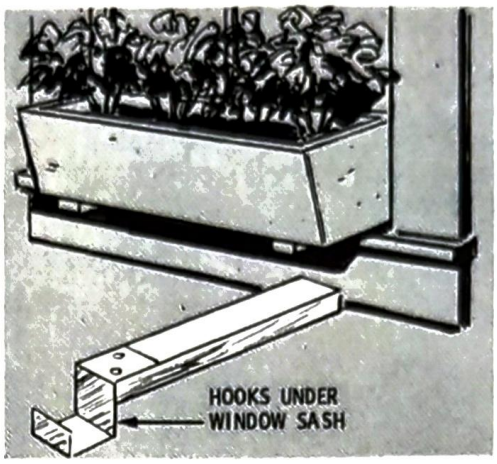
■ GIFTS that are unusual are always happy surprises, and the simple elegance of this one will become more exciting when the candle is lighted. Known as a Danish candle, the flame burns in a recess, giving an iridescent, translucent glow.

The three-legged candle holder is formed from 8-in. lengths of ¼-in. brass rod, each leg being formed to the shape indicated in a jig as pictured here. To bend each leg, clamp the jig to the bench top, remove the center stop and make the first or cup bend. Then replace the stop and make the second bend. The stops are 5/16-in. washers held with screws and positioned to coincide with the leg outline which is drawn full size on the jig. Place five or six washers on each.

After the legs have been soldered together, mold the candle in a 3-in. hollow rubber ball cut in half. You'll need two holes—one for the wick and one for pouring. When hard, just peel off the ball and smooth the surface.

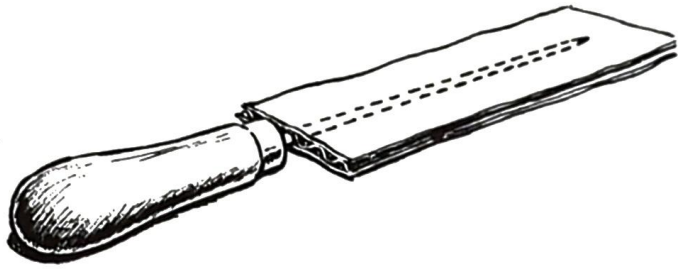


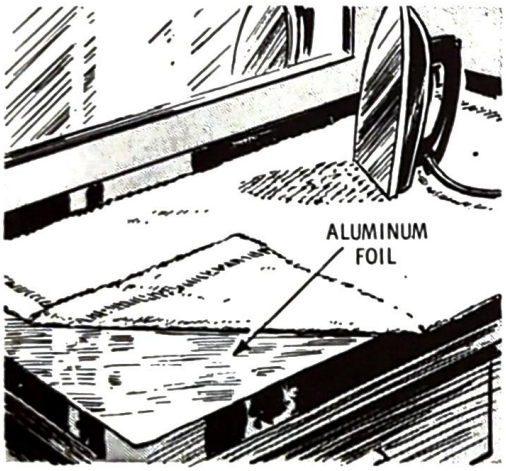
By sewing hooks and eyes to the back of your drapes, they can be lifted out of the way when cleaning or waxing the floor.



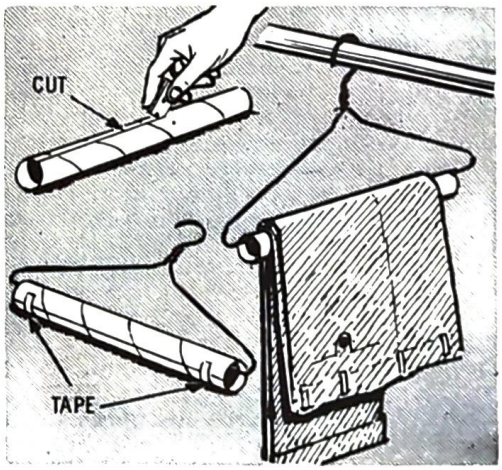
Supports which hook under the sash can hold permanent inside window boxes. Bend 26-ga. galvanized straps to fit the window and finish the supports to match the box.

A strip of corrugated cardboard makes a good safety sheath for an ice pick. When it wears out, you can make another in a few minutes.

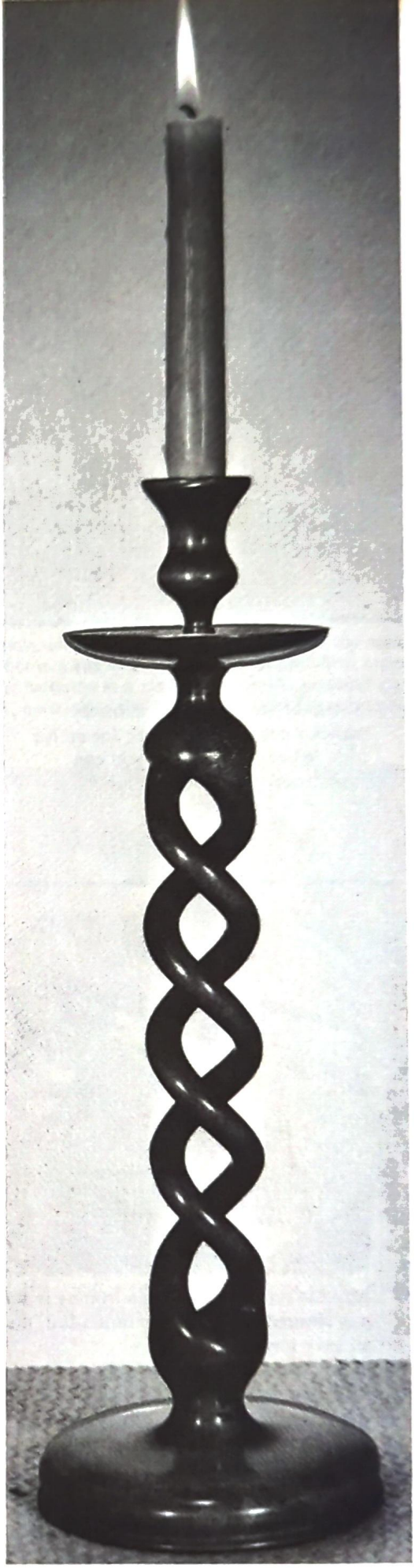




Any flat suface becomes an ironing board when it is covered first with aluminum foil, then with a heavy towel.



Cut a cardboard mailing tube lengthwise and tape it over a wire coathanger to produce a no-crease pants hanger.

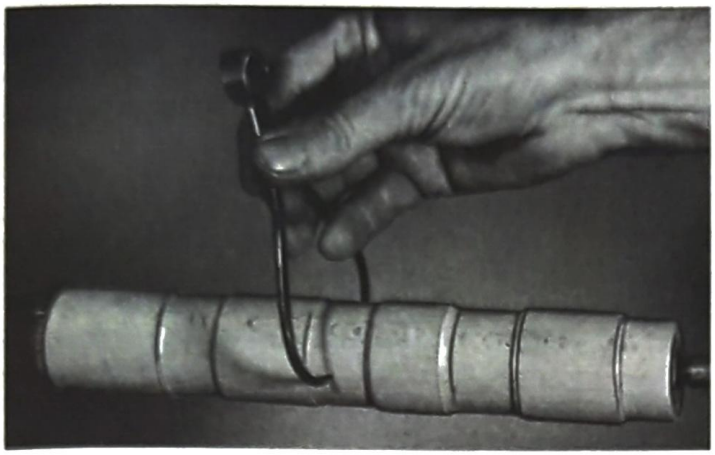


Double-spiral candlestick

BY E. R. HAAN

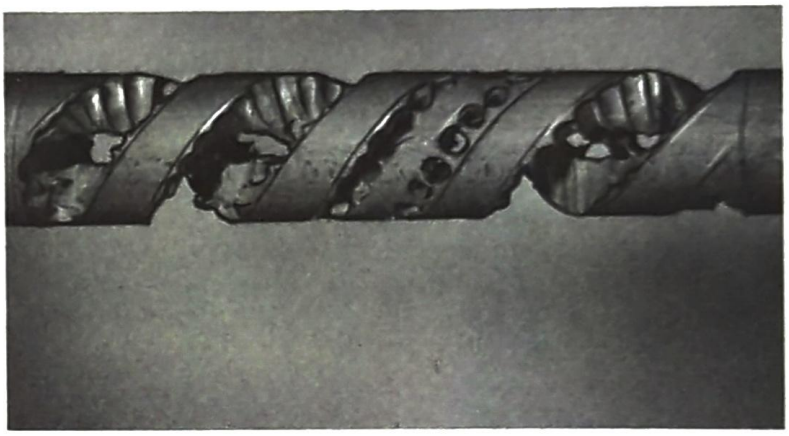
IT LOOKS as if this candlestick was simply twisted. But when you consider it's wood, you know better. The trick is explained in the four photos on the next page which show how the candlestick starts out as a plain tapered turning and winds up as a beautiful double-spiral, hand-fashioned while held between lathe centers.

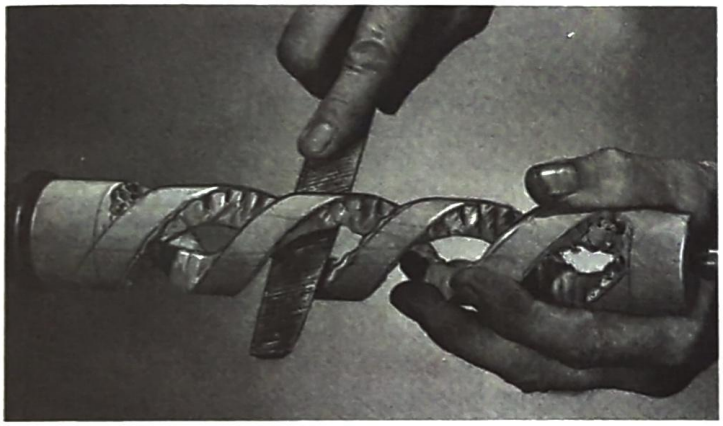
As shown in the drawing on page 456, each candlestick consists of four turned parts, doweled together. To lay out the spiral portion, pencil four longitudinal lines on the cylinder to divide its



The tapered cylinder for the spiral section is formed by first turning to diameters which are successively smaller by 1/16 in. at five equidistant points. The remainder is then dressed down. The cylinder is now ready for layout of the spirals

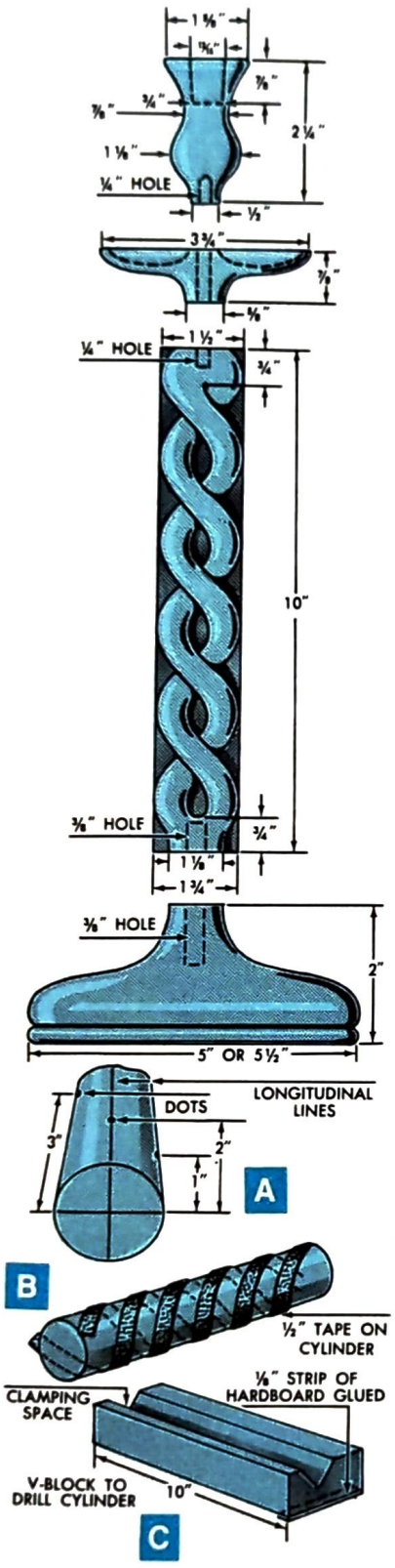
Overlapping holes are drilled diametrically entirely through the waste between the spiral lines of masking tape. Use a drillpress and twist drills; flat bits or auger bits won't work. Waste may have to be freed with a fret saw or keyhole saw





The double spirals become almost square in cross section after rough edges are dressed down with a rasp. Further filing makes them octagonal or slightly rounded. For this operation, and sanding, work is best held between the lathe centers

Rounding the spirals is done with strips of abrasive cloth about ½ in. wide. Use coarse, medium and fine grades successively. Attractive grain comes out as the finish gets smooth. Entire rounding operation may take about 4 hours



circumference into quarters. Make a dot 1 in. from the end on one of these lines, another dot 2 in. from the end on the next line, a third dot 3 in. from the end on the third line, as shown in detail A. Continue in this manner.

Next, apply a length of ½-in. drafting tape spirally around the cylinder so that one edge touches the dots. Then apply a second length of tape, centering it precisely between the spirals formed by the first one. Detail B shows the tape properly applied. You can pencil lines along the edges of the tape and remove it, or you can leave the tape intact. The wood between the tape, except that at the ends of the cylinder, is to be removed.

Removal of the wood is accomplished by first drilling diametrically through the cylinder, using a drill press and a ⅜-in. twist drill. The holes are overlapped and positioned along the edges of the tape or marked lines. *Don't* use flat wood-boring or regular auger bits. Drill slowly when breaking through, to minimize ragged edges.

V-block holds cylinder

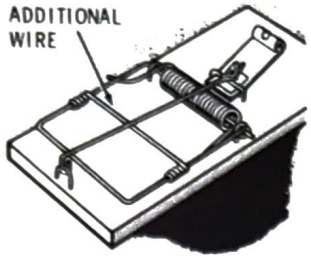
To hold the cylinder for drilling, use a 10-in. length of 2 x 4 with a 45-deg. V-groove sawed lengthwise as shown in detail C. To assure drilling at right angles to the axis of the cylinder, glue a ⅛-in. shim under the end of the block supporting the smaller diameter of the cylinder. After clamping the block to the drill-press table, center the drill precisely over the V-groove. Then all you have to do is move the cylinder in the groove for drilling each of the overlapping holes. Near the ends of the cylinder, both rows of holes converge in a semicircle. If any wood remains between adjacent holes where you missed overlapping them, use a fret-saw or tiny keyhole saw to free the waste.

After the waste has been removed, replace the cylinder between the centers in the lathe. Next, work down the ragged edges with a rasp. Then, using strips of emery cloth or coarse-grit paper torn from a sanding belt, round the spirals. This will be easier if you wedge the headstock to hold the work stationary at any desired point.

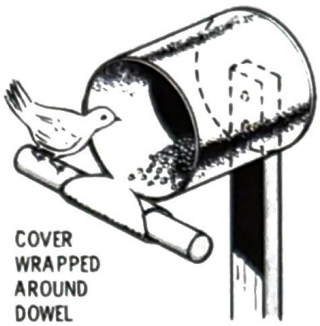
Holes for the dowels in the spiral portion can be bored in the lathe by using a chuck and drill mounted at the tailstock and fed to the work while rotating the work by hand. After assembling the parts with dowels and glue, and allowing to dry thoroughly, the ends of the spiral section are turned down to join the drip cup. Sanding and a coat of clear lacquer finish the job.

See also: candle holders; candles.

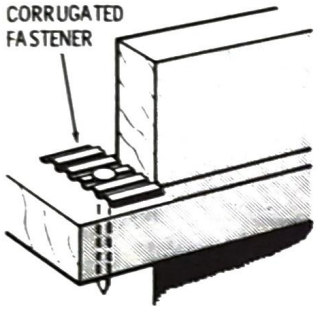
To make a tool oiler, fill a jar half full of oil and plug the top with a rolled felt stopper. Nails keep the felt off the bottom. To use it, invert the jar and rub lightly on the tool.



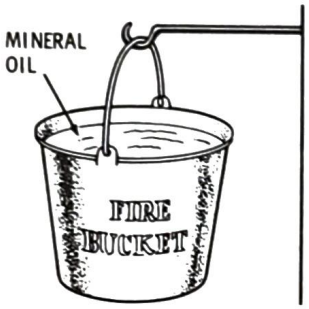
An additional bar fastened to your rat trap converts it to combination mouse-and-rat trap.



Tin cans make fine bird feeders if you don't completely cut the tops off when opening them. Roll the lids around dowel perches.

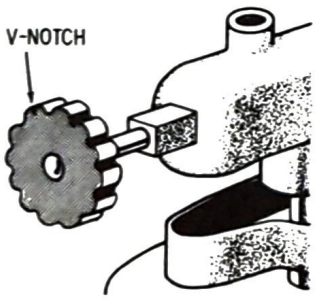


Bore a hole through a corrugated corner fastener and your bench, drop in a shingle nail, and you have a removable bench stop.



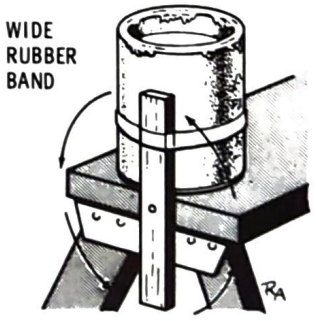
Retard evaporation of water from standing containers by dropping just enough mineral oil onto the surface to seal off the air.

Uncurl shipping labels with a rubber band. Then draw them from the inside as needed.



Don't force the needle valve of a blowtorch closed or you may damage it. As a reminder and guide, file a notch on the knob that will indicate the proper closing position.

A midget mortar-and-pestle for photo chemicals can be improvised by using a spoon and a glass caster cup.



A swing-up holder fastened to your paint can with a large rubber band will keep the paint from skidding off your stepladder.

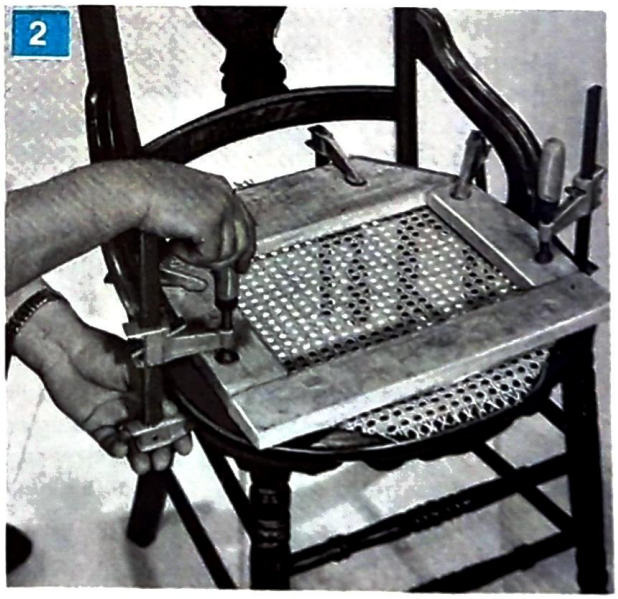
New seat for a chair

By W. CLYDE LAMMEY

Reseating old chairs with rush or cane is a rewarding craft with its own challenge to hand skills

After cleaning the chair seat run a single bead of glue around the frame inside the holes. Cut a length of heavy electric cord to fit outside the glue line

Place the caning, locate the cord "ring" over it and place the clamping cauls over the cord as pictured. Space and draw down the C-clamps uniformly



THAT VENERABLE rush-seated chair in your attic may be nearly seatless because of its years and quite likely that's the reason it's been relegated to the dust and cobwebs. Or it may have been a cherished cane seated chair at some time or other and the caning let go after a generation or so of use. Rerush or recane the seat and you have an attractive and useful chair.

Reseating a chair is a lot easier to do than you may think. Once you get the "hang" of it, you'll find rush seating a simple weaving job.

Here's how you go about it: First, remove the old seating, clean the chair with a mild soap solution to remove the grime, then sand and refinish if necessary. There are two kinds of rush seating commonly used, the commercial fiber rush and the natural cattail rush. Both can be purchased ready for use. In wear properties one is as good as the other but the natural rush "goes" with old chairs, such as those having ladder backs like the one illustrated, or an original "name" chair such as the Hitchcock.

The average chair takes about 1½ lb. (dry weight) of natural rush seating material but it's well to have a little over in case you turn up a few under or oversize strands or damage several in the weaving. Place the bundle of rushes in water and allow to soak overnight, weighting

them if necessary to assure complete immersion. Then run them through the wringer of the washing machine. Lacking the wringer, sneak the use of the wife's rolling pin, spread the wetted rushes on a flat surface and roll out excess water. Or use your lawn roller, partially weighted.

Have ready at hand a ruler, scissors or snips, and a hook made as in the detail. Place the chair on a low table or bench at a convenient height and then take a long, close look at the weaving sequence in Figs. 5 and 6 to acquaint yourself with the start of the weaving pattern. Most chair seats like that pictured in Figs. 7 through 12 are wider at the front than at the back so you start the weaving in this fashion: With the chair facing you, select two rushes, one tip and one butt length. The tip is the top growth and the butt is the lower, or stalk growth. Twist the middle section of the two strands and loop over the back rung of the seat frame, temporarily fastening one half the length to the chair back. The working end of the strand is kept twisted quite tightly as illustrated and brought toward you, looped over the front rung at the left chair leg, then down around and up through the frame and over the left side rung. Notice that only one half the strand is worked at a time; the other is tied off temporarily. Repeat this same wrapping step twice as indicated; then continue the twisted strand across to the opposite side rung. Here it is looped around the rung, up through the frame, around the front rung twice as before and finally is carried back to the rear post and tied.

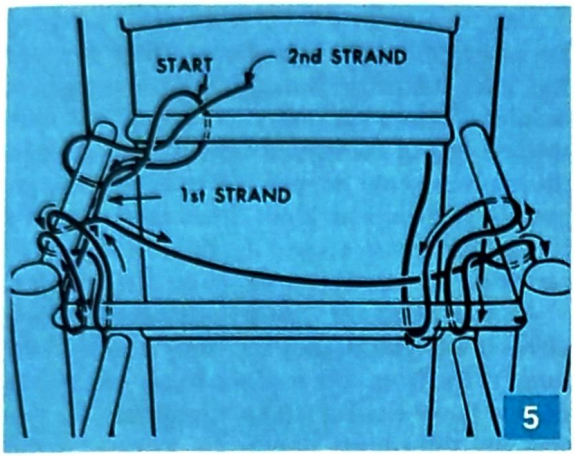
Now back to the starting point where you loop the other half of the strand around the left rear leg. Then following through with the same procedure as before you end where you left off with the first half of the twisted strands. At this point the two halves are merged and continued as one, passing it over and around the rear rung, up through the frame, around the side rung and back across to the starting point at the left rear leg.

As you bring the strand forward again you divide it into two strands and bring it around the rungs at the front corner of the frame just as was done with the starting strand, except that the second and subsequent strands are looped around the rungs only once. At the right rear leg the strands are again merged into one, which is looped around the rungs and brought back to the starting point.

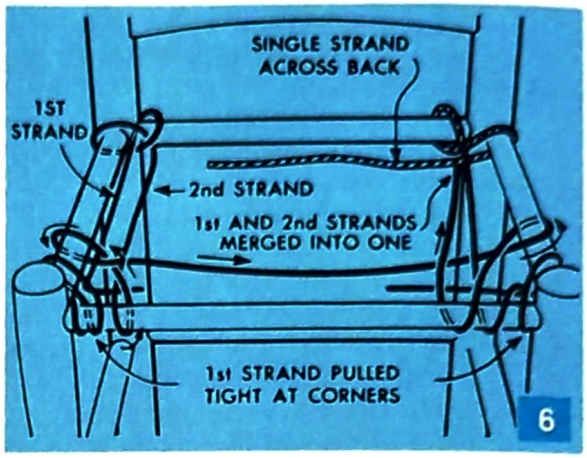
Each time around, one strand is added across the back, two along the sides and two across the front. This trick has the effect of building out the slanting sides of the seat frame twice as fast at the front as at the back. You repeat the procedure until the remaining opening at the center of the partially woven seat squares up. Then a single strand is used. Usually the sides of the frame are shorter and they tend to close up first; when this point is reached the strands are carried back and forth from front to back rungs in a figure-8 pattern, passing the strands under at the center opening. As the center opening gradually closes use the hook—it's shaped like an oversize crochet hook—to catch the strand

After glue has set trim seating around the outside of the electric cord, using a sharp knife. Lift or pry up the cord being careful not to loosen the seating

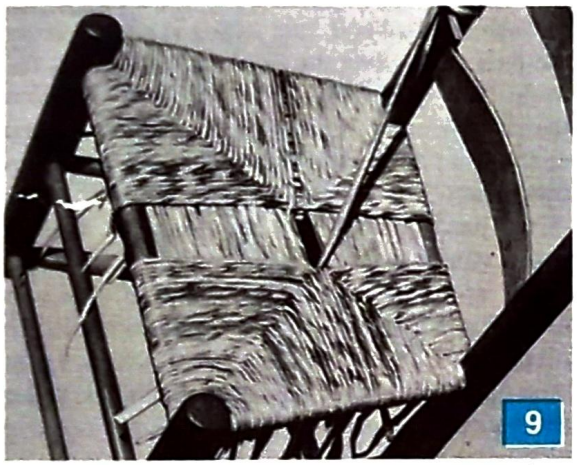
Finish with a strand of cane binding, the latter being held in place by loops of a second strand dampened to make it pliable. Finish seat with varnish



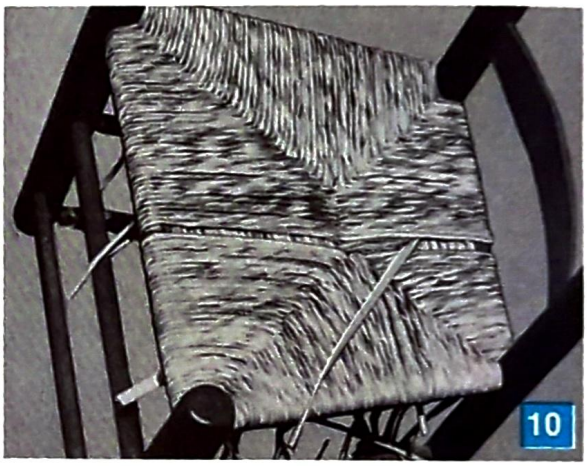
Here's how you start the weaving. Notice closely the direction and looping of the first strand. Always keep the working strand twisted tightly



Now comes the first "merging" of the strands and at this point the weaving begins to show. Remember to keep those strands tight at the corners



It won't be long now! Just a few more strands and that's it. Here you simply weave the strand up through the opening and around front and back rungs



A couple more strands does it neatly. You'll have to use your hook to grab those last ones and pull them through the opening at the center

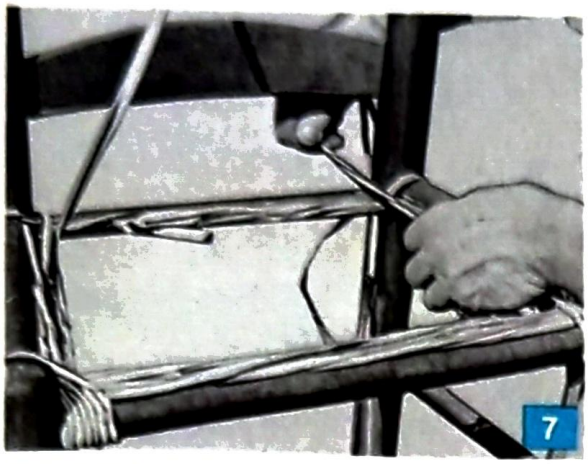
reseating chairs, continued

and pull it through the narrowing opening. Work the opening fully closed, clip off the loose ends of rush projecting from the bottom of the seat.

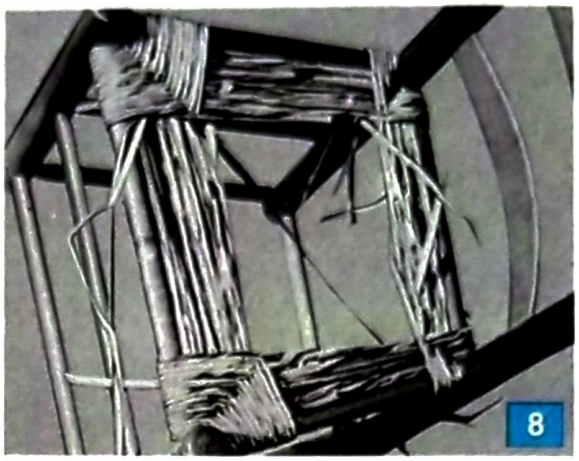
Should you be working a chair having side rungs higher than the front rungs, you stuff the seating as you go along, pressing the stuffing (use scraps of the rush) between the lays of rush at the front of the seat. The rear section of the seat is not stuffed. One last caution: Don't allow the wetted rush to dry out; keep it dampened and always keep the strand you're weaving twisted fairly tight. Otherwise you'll likely end up with a loose seat that won't wear well. And keep those strands pressed closely together as you weave. When it's dry, varnish the top and bottom of the seat, preferably applying by spray.

Cane-seating a chair is no problem at all when you use pre-woven caning as in Figs. 1 through 4. The seating comes ready to apply and in units sufficiently oversize to fit most chairs of the type having frames taking cane seating. First you clean up the chair, refinish if necessary and make sure all the holes taking the original caning are clear. Next you cut four clamping boards, or cauls, from 1-in. stock to fit the chair-seat frame as in one of the illustrations. Then you measure and cut a length of heavy plastic-insulated electrical cord which will fit snugly into the groove in which the holes taking the caning are located. When in place the ends of the cord should butt; tap it into place to make sure by trial.

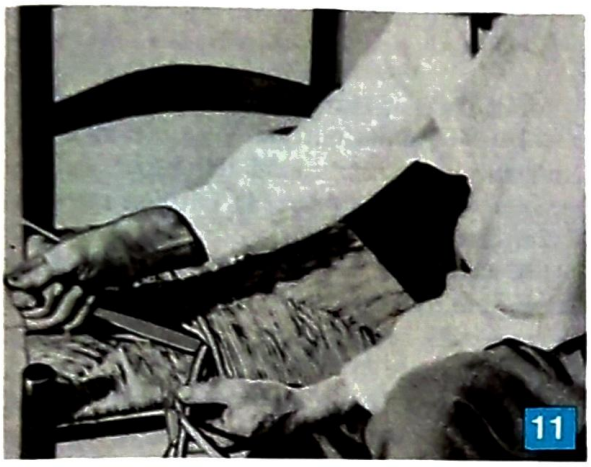
Now, with everything in readiness—cauls, C-clamps, seating (untrimmed) cord and white glue, run a line of glue around the seat frame



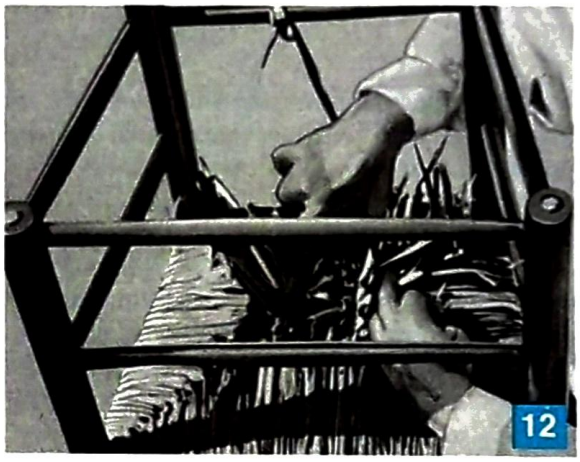
At the start the weaving should look like this. The trick is to keep a uniform tension and a fairly tight twist on the working strand



Add a few more strands and your weaving begins to show. Be sure to keep the windings pressed rather tightly together on the rungs



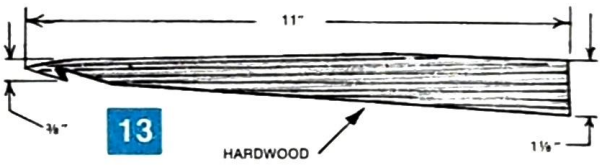
Where side rungs are higher than those at the front and back the front portion of the seat is stuffed, or padded, with scraps of rush



As the final step you trim off all the loose ends on the bottom of the finished seat. Spray top and bottom of the seat with varnish from aerosol can

just inside the groove as pictured. Then quickly, before the glue begins to set, place the untrimmed seating, squaring it with the frame. Press the electrical cord into place, locate the cauls as pictured and clamp them down tightly, spacing the C-clamps uniformly all the way around the frame. Wipe off any excess glue on the inner edges of the seat frame and allow the work to remain clamped for at least an hour.

Then remove clamps and cauls and trim the waste from the seating, running the knife along the outer edge of the cord as pictured. Carefully pry up the cord and remove it. Finish the seat with a cane binding which is a single strand held in place with loops formed by passing a strand of regular cane through a hole from the top side, tacking the free end to the underside of the frame and forming successive loops, one in each hole,

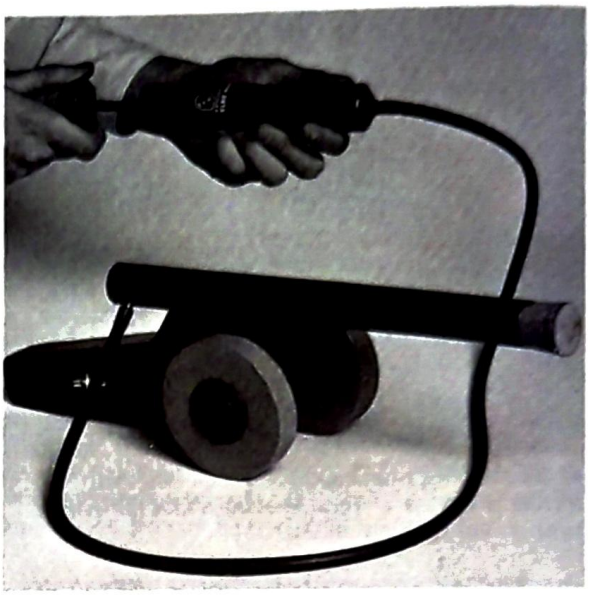


You make this essential tool yourself from a piece of hardwood. It's used for pulling and stuffing the rush through and into the seating

the loop being formed by passing the cane up through the next hole, over the binding strip and down through the same hole. Continue this procedure with all holes in the seat, then tack the free end to the bottom of the seat frame. When finished, varnish the seat top and bottom.

See also: legs, furniture; rocking chair; rustic furniture; upholstery.

Your kids will get a bang out of this



By HOWARD W. TETER

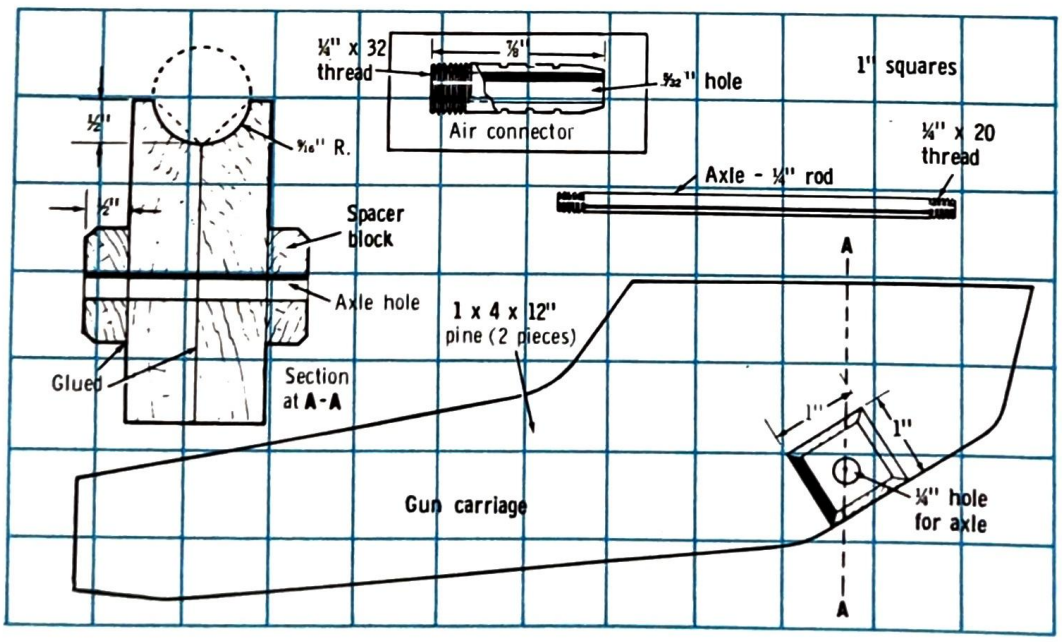
IF YOU WANT to become a favorite uncle or make a hit with your own kids, make this Big Bertha cannon. It's perfectly safe indoors, since the "shells" are corks and the explosive is compressed air delivered by a hand pump.

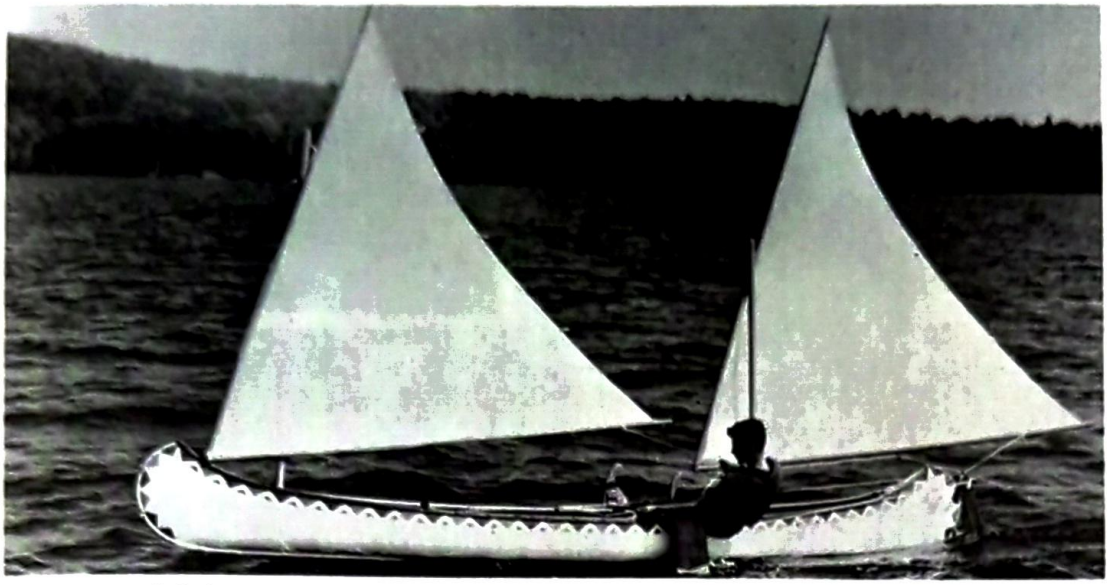
The 13-in.-long barrel is 1¼-in. thinwall conduit. Solder a disc of sheet brass in one end so the barrel is airtight when corked. About ½ in. from this end, drill and tap a 7/32-in. hole to take one end of a piece of ¼-in. brass pipe cut 1 in. long in a drive fit. For strength, solder this piece, which is your air connection. File two or three crosswise grooves on the unthreaded end to grip rubber tubing. Smooth and round the inside lip of the muzzle and polish the last inch.

Make the gun carriage according to the pattern below. Round out the V-groove in it with sandpaper wrapped around the barrel and bed the barrel with epoxy cement. Glue on the wheel spacer blocks.

The wheels are also made from 1-in. stock and have a 2-in. radius. Drill ¼-in. holes through the spacer blocks, carriage and wheels for the axle. The axle is made from ¼-in. brass tank float rod, cut to a 4⅝-in. length and threaded ¼-20. Use washers on both sides of the wheels; turn on nuts, and peen the ends of the axle. Tack on cocoa-tin lids for hub caps.

Hook a piece of windshield wiper hose to the air connection and attach a football or tire pump.





Two masts and their 100 sq. ft. of sail make up the full sailing rig for an expert. A novice should begin with a single mast and about 40 ft. of sail. Sails and masts designed for a canoe are easily set up and dismantled

Which canoe is best for you?

BY JACK CUSHMAN

Here's what to look for when you shop

THERE ARE MORE CANOES being paddled in the U.S. today than in the heyday of the Indian nations. Although the canoe has changed outwardly since that era, it is still much the same basically.

Fiberglass and aluminum have all but taken over as the material used in canoe construction.

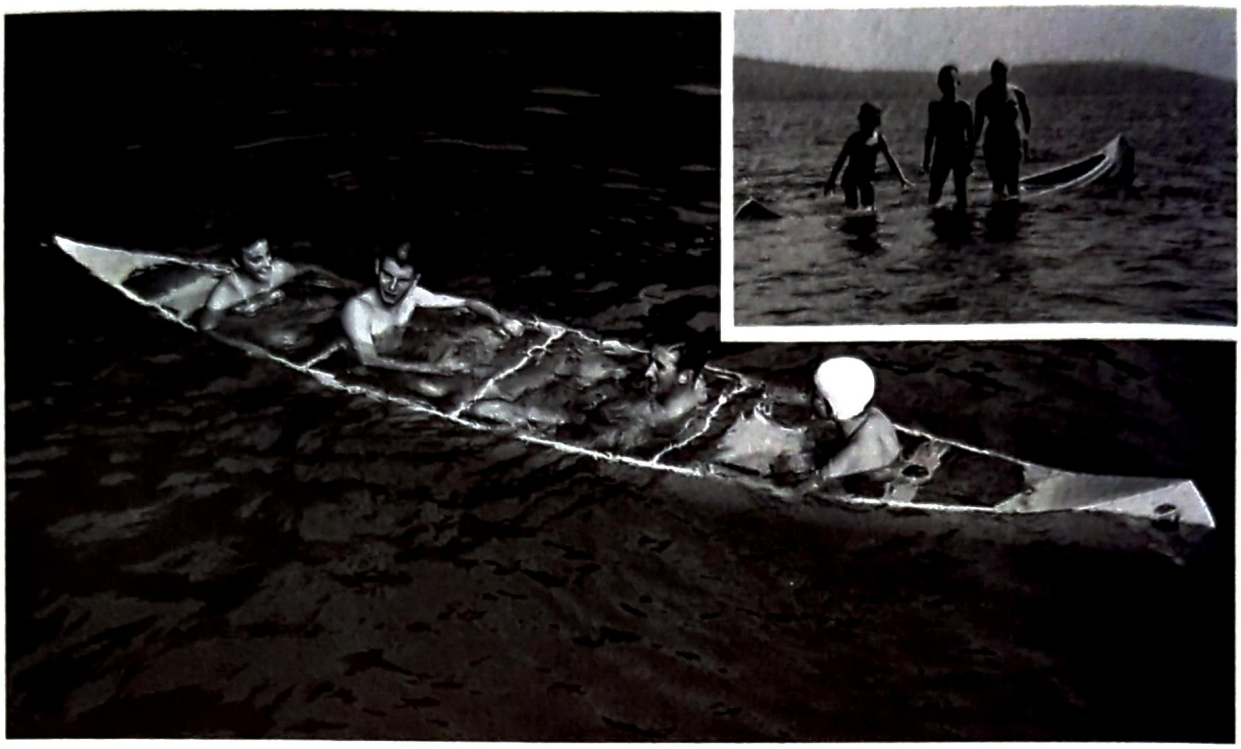
A pair of outriggers can be improvised with two lengths of 2 x 4, two innertubes and four C-clamps. Outriggers increase safety for beginners

A few old firms are still producing fine wood-and-canvas canoes, and some custom craftsmen will make all-wood canoes on order, but fiberglass and aluminum—tough materials that require little care and are easily repaired—have cornered the mass market. Both sell for about half the price of a good wood and canvas canoe.

There is considerable debate about the relative merits of fiberglass and aluminum, but experience has shown one to be as good as the other. Aluminum is noisy, but not in the hands of an experienced paddler. It dents, but is easily repaired.

Fiberglass has a tendency to stick on rocks, but this is hardly noticeable unless you are racing for seconds. Breaks are more common in the fiberglass hull, but they are also more easily re-

canvas top, boat: see convertible top, boat
capacitor flash box: see flash box, photo
carbon monoxide poisoning: see mufflers, auto



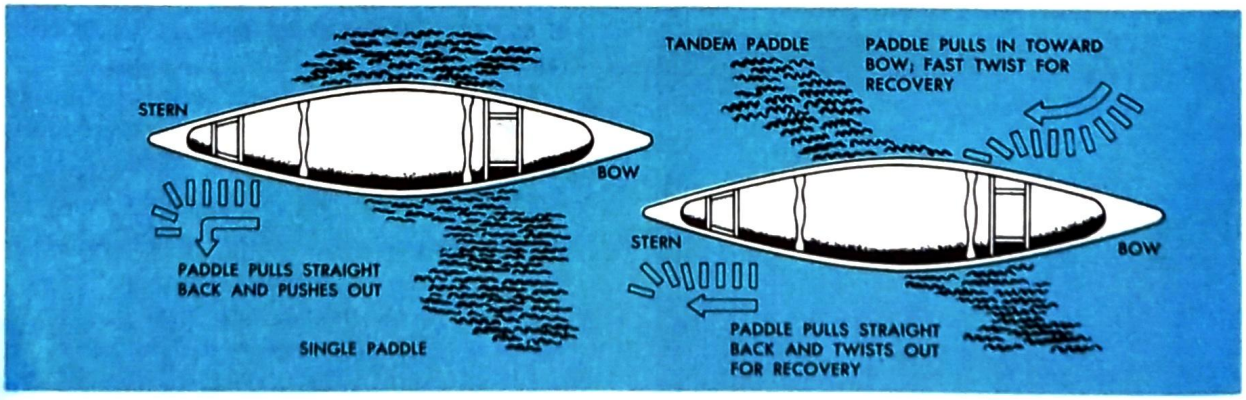
Flotation chambers in most aluminum and fiberglass canoes will keep a swamped craft afloat. A sponson canoe (inset) with an air chamber on each side is almost impossible to tip

paired. Fiberglass canoes frequently—but not always—weigh a little more than aluminum canoes of the same length.

A narrow-beamed, round-bottom canoe with a small, flat shoe keel is ideal for river and streams. It requires some balancing skill, but it is fast, easily paddled by one man, and is highly maneuverable among boulders and in white water. For lake travel, where there is the chance of fresh-water chop, the wide-beamed canoe with a flat bottom extending to both ends, and the larger lake keel is the ideal. It does not tip easily, and the longer keel helps to eliminate yaw when paddling. Also, it resists the wind. The lake canoe should have bow and stern cut as low as possible. The old-style crescent ends act like cumbersome sails in a strong breeze.

For family canoeing, where safety is a major factor, the most popular make of aluminum canoe incorporates sealed air chambers that make the craft unsinkable. There is also the sponson canoe that has an air chamber on each side, extending from bow to stern. This raises the cost of the canoe above the average, but it is virtually impossible to turn it over, and even when swamped it will ride high in the water.

The power of the stroke is in the pull to a point even with the body. As the paddle passes the hip, a single paddler makes a J-stroke. With two men, the bow man pulls toward himself



A canoe is easily adapted to an outboard motor. A motor mount is simply a piece of heavy plank bolted to the hull and extending off the stern to accommodate the motor clamp, and it can be built for almost nothing. A 1½ to 3-hp. motor is recommended for a regular canoe. For greater speed, the square ender, a canoe fitted with a transom, will accommodate a 5½-hp. motor. It is also possible to install an air drive with a 2-hp. motor, and this rig will navigate in 2 in. of water.

Paddling a canoe is simple if you remember that all the power of the stroke is in the pull up to the body. The recovery, whether you use the "J" or "figure-8" stroke, is simply for steering and ease of removing the paddle from the water.

The position of the paddler is governed by water conditions. In calm water it is comfortable to paddle from the seats. In rough water it is best to kneel, bringing the weight closer to the waterline, and move more to the center of the boat. A lone canoeist can usually handle his craft in rough water by paddling from the center, but to keep a straight course against strong winds, he moves to the extreme bow.

Sailing a canoe in a good wind has been described by one sailor as "like doing a toe dance on a toothpick." A novice should begin with a commercial rig, complete and ready to be installed, that has a short mast and about 40 sq. ft. of sail. As he gains experience he can graduate to a larger mast and up to 75 ft. of sail, and finally to two masts that spread 100 sq. ft. of sail over the canoe.

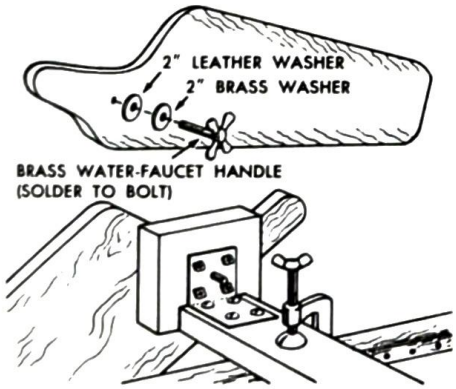
A pair of outriggers increase safety for the beginning sailor and young paddler. They are easily improvised with two lengths of 2 x 4, two innertubes and four C-clamps. Simply lay 6-ft. lengths of 2 x 4 evenly across the center of the canoe, clamp them to the gunwales, and stretch the innertubes over their ends. This pair of simple outriggers will make the canoe as stable as a raft, except perhaps under extreme conditions.

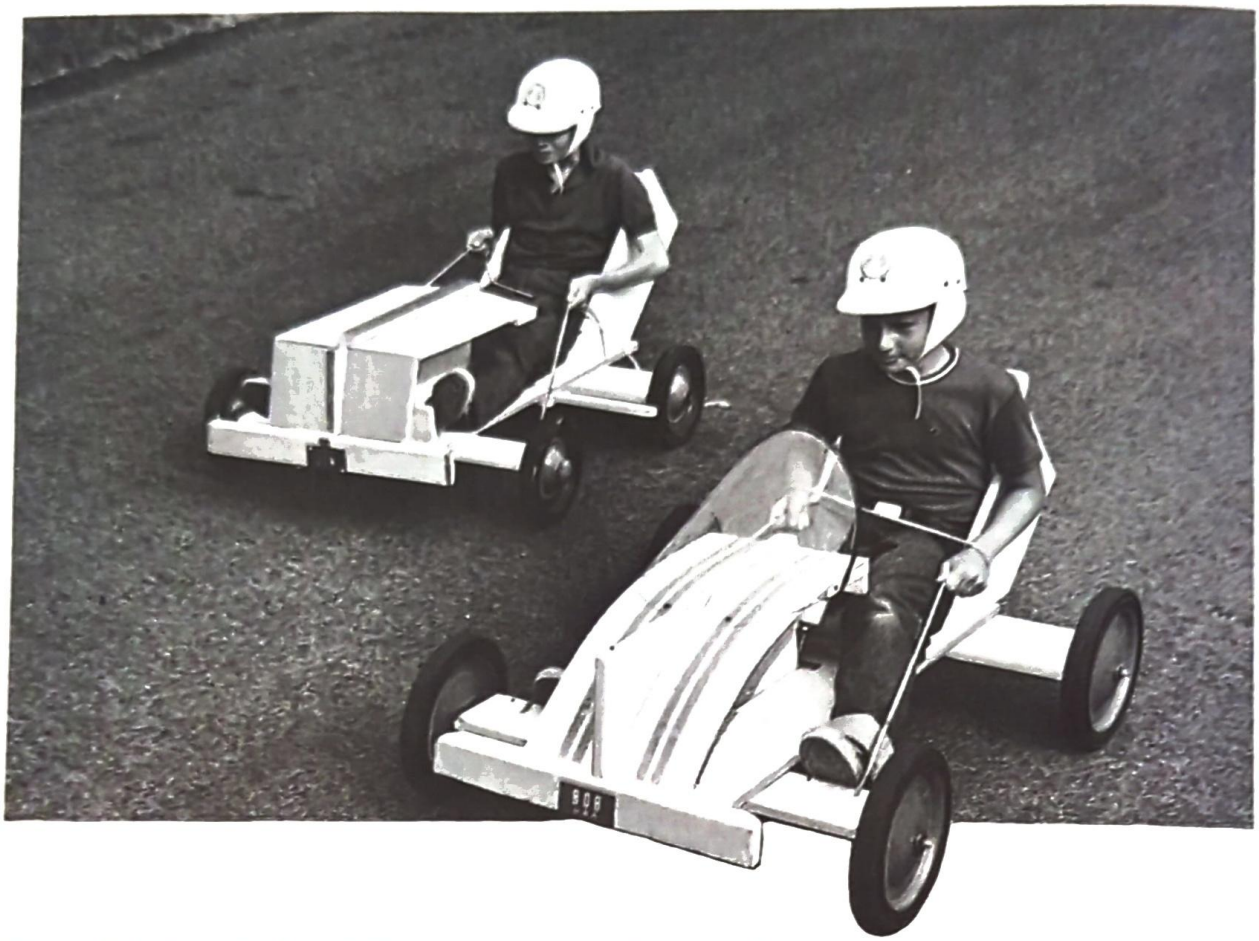
The secret, then, when buying a new canoe, is to decide ahead of time exactly what you will use it for. A different type is needed for white water, stream or lake, and for sailing, paddling or motoring. And shop for durability. Even a canoe that is just used for family fun can take an awful beating each summer.

See also: bicycle boat; boats, buying; boats, used; kayaks; paddleboat; pontoon boat; sailboard; sailboat; water skiing.

A square ender, made of aluminum, with transom, is driven here by a 3-hp. outboard. However, it will take up to 5½-hp.

Lee boards on both sides of a canoe take the place of a centerboard for sailing. Main crosspiece in homemade boards is C-clamped to the gunwales

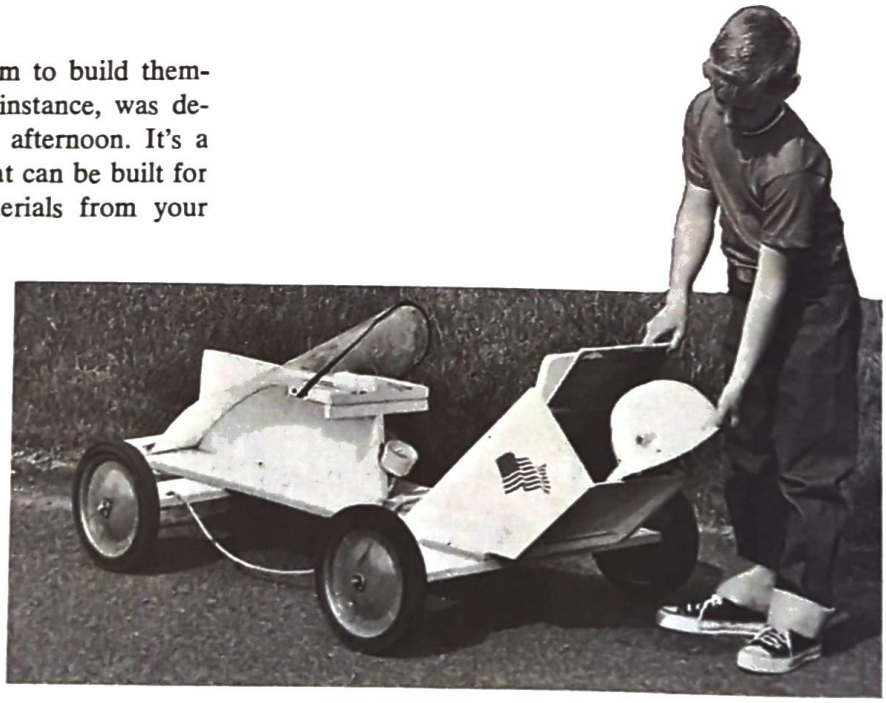




Build this 'Grand Prix' coaster for downhill racing

By FRED WOLFF

SOME PROJECTS almost seem to build themselves. This little coaster, for instance, was designed and constructed in one afternoon. It's a great father-and-son project that can be built for practically nothing, using materials from your scrap box.



Roomy trunk provides plenty of room for helmet or toolkit. Note bike speedometer mounted on center console. It's connected to a rear wheel

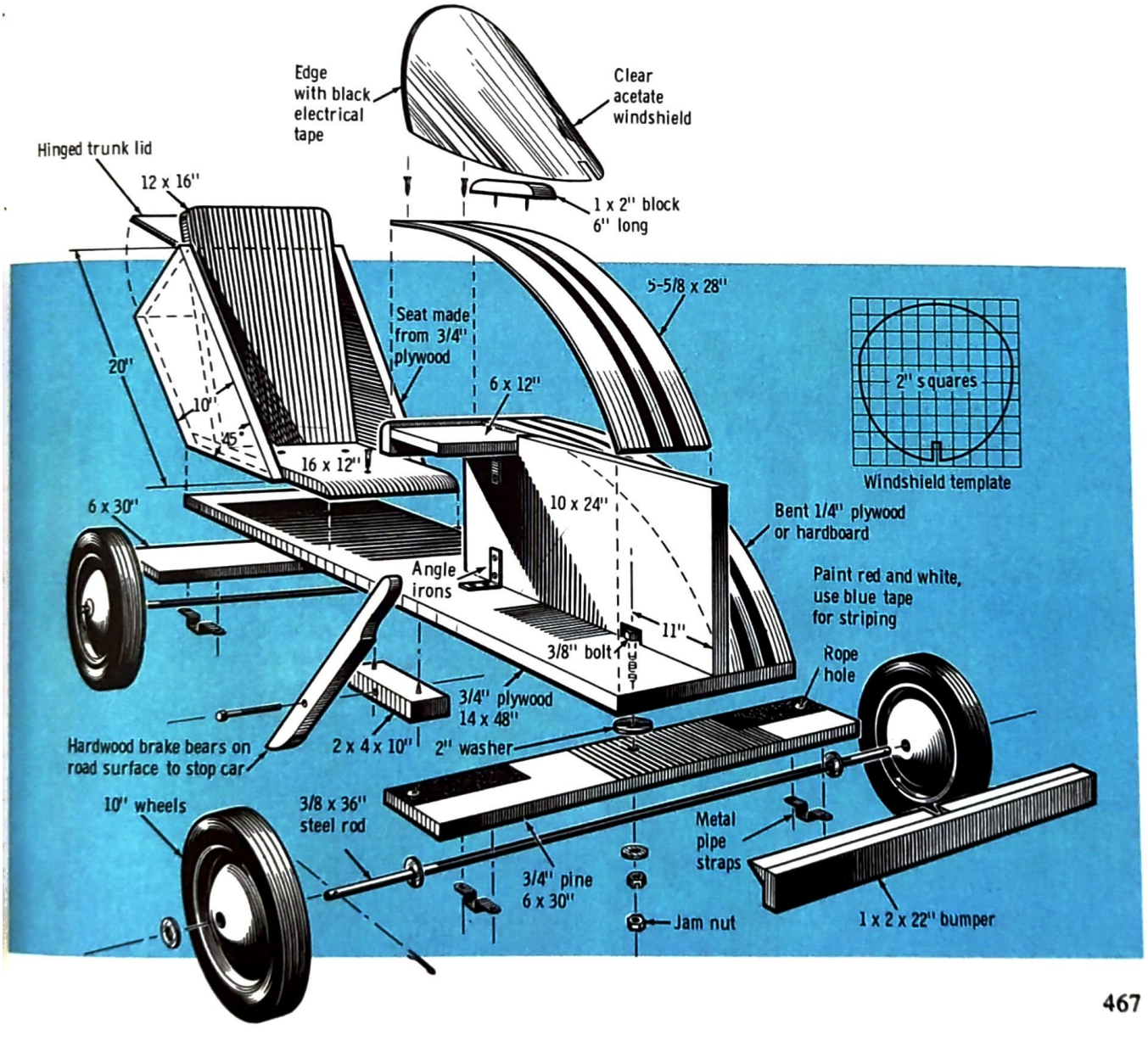
Building a coaster was my son's idea. I had just completed a built-in cabinet and was cleaning up the leftover pieces of lumber and hardboard when my boy wandered into the shop. "You know," he said, "I bet there's enough stuff there to make something." The next thing I knew, we were sketching out plans for a coaster.

The design was improvised to make use of scrap-box materials with a minimum of cutting. The only things we had to buy were the four wheels and the acetate for the windshield, which came from an art supply store.

That unusual "hood line" also was Robert's idea. I had planned to cut the center board to a curve matching that of the hardboard, but my co-designer preferred the squarish spear effect, so we left it square. Any details can be changed to suit the materials available. With scrapbox design, the sky's the limit.

See also: cars, sidewalk: classic roadster; scoot-car.

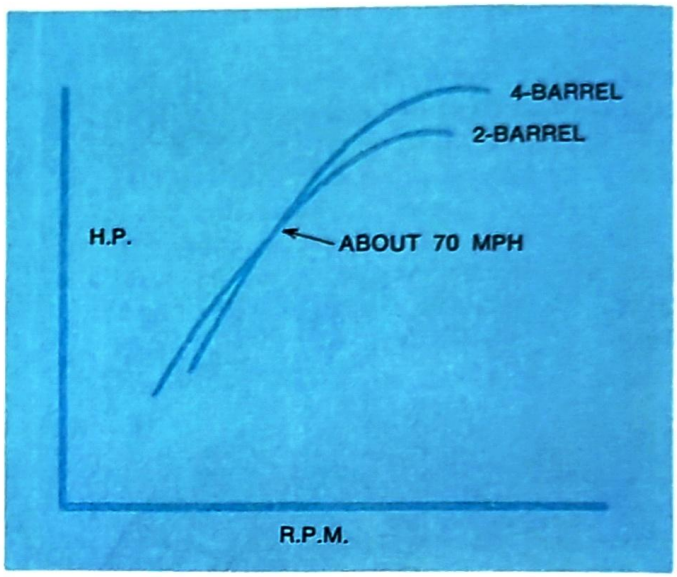
Chassis view shows how speedometer cables goes out bottom and back to rear wheel. Rear axle board is nailed to chassis, front one bolts to plywood



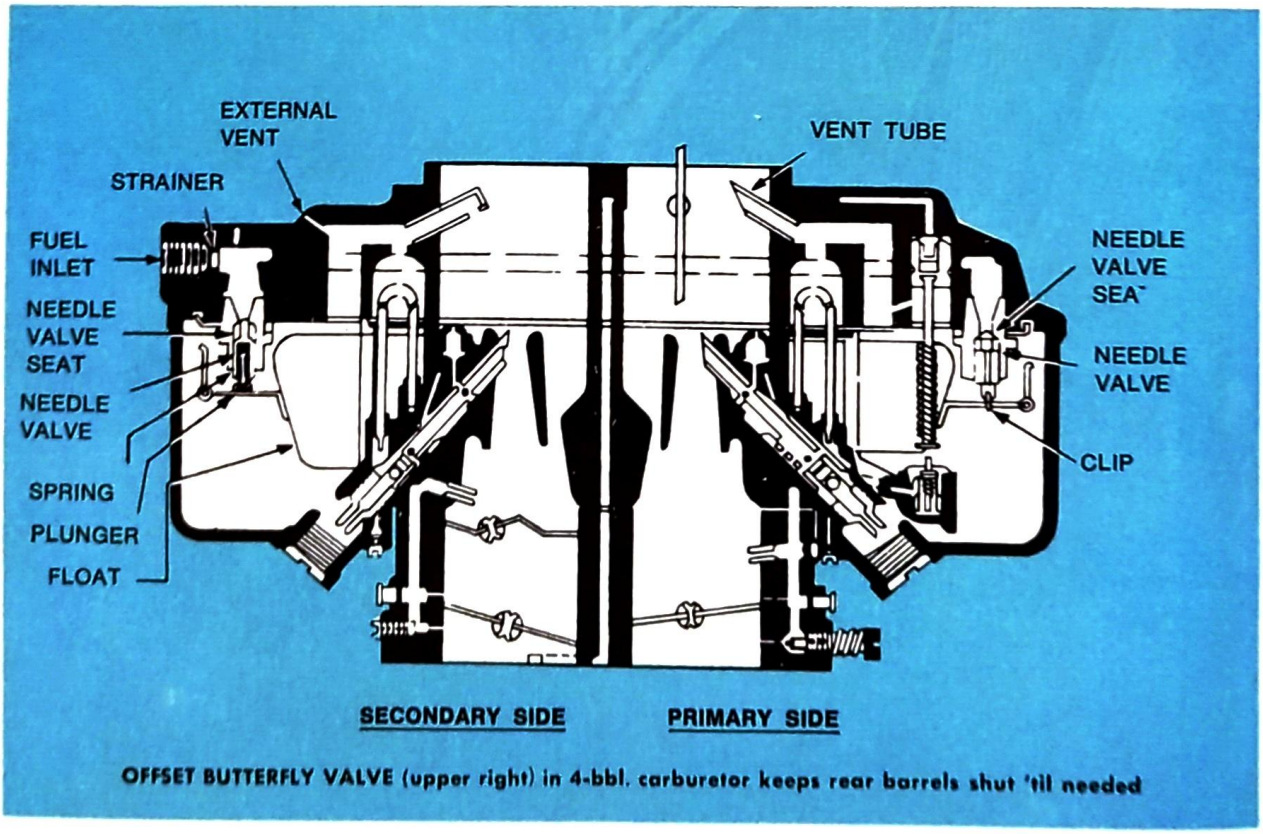
The ABCs of carburetion

By ROGER HUNTINGTON

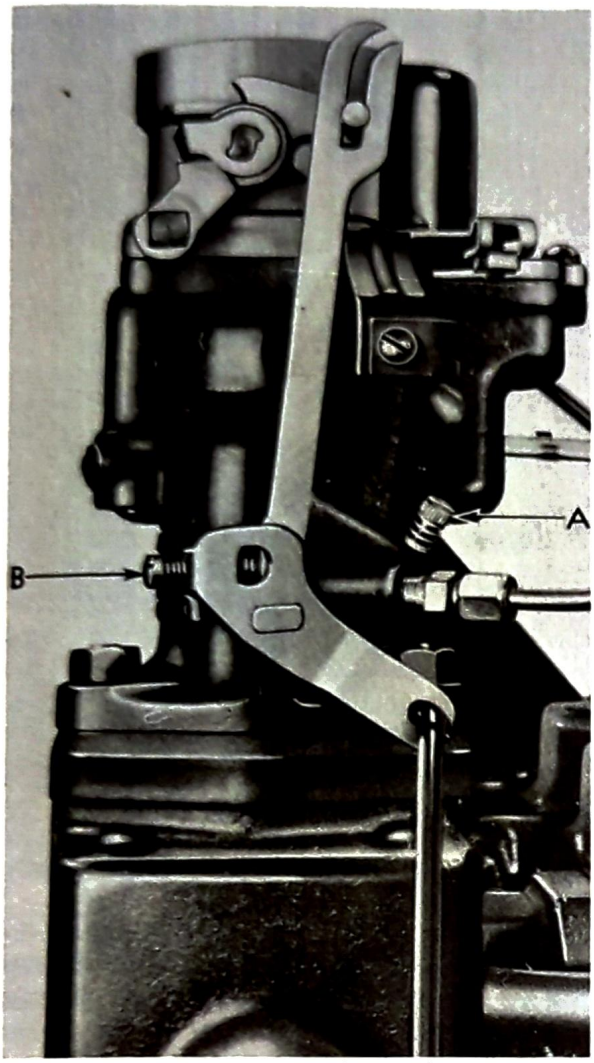
The modern automotive carburetor is a mechanical marvel offering engine efficiency and quick response over a wide power range in combination with restrained fuel consumption



Capacity affects both ends of power curve. A 4-barrel rig breathes better at speed, may be sluggish at the low end



OFFSET BUTTERFLY VALVE (upper right) in 4-bbl. carburetor keeps rear barrels shut 'til needed



Important adjustments on a modern carburetor are the idle-mixture needle screw (A) and idle-speed screw (B)

■ IN ANY INTERNAL COMBUSTION engine—like those that power our cars, trucks and boats—liquid fuel must be mixed with a certain amount of air to form a combustible mixture that will ignite instantly and burn so fast it amounts to an explosion within the engine's cylinders.

One approach is to let the cylinder get its own air, sucking it in on the intake stroke, and positively squirt a fuel charge into an intake port or—using a nozzle—directly into a cylinder. That is, generally, the system that's used with diesel or fuel-injection engines.

The carburetor of today, however, is a simpler and cheaper approach—although neither as simple nor as cheap as it once was, for good and sufficient reasons.

The fuel-air charge can be burned efficiently in the combustion chamber only when the mixture is within certain limits, about 12 to 15 parts of air (by weight) to 1 part of fuel for normal, steady engine speeds. That means the carburetor must do its mixing job accurately.

Mounted outside the engine proper, carburetors pass the mixture to the passages of the intake manifold, where engine suction pulls it into the combustion chamber of each cylinder. And carburetors, with varying degrees of sophistication and complexity, have been doing the job successfully for more than 60 years.

The job handed to today's carburetor, however, is more complex than it seems on the surface. The air-fuel mix has to be right for a wide range of engine speeds and loads. But the carb must offer a minimum of power-robbing restrictions to the engine's ability to breathe in air.

a complicated assignment

The carburetor must meter a "lean" air-fuel mix to the engine for cruising, a richer mixture both for idling and for maximum power. A modern carburetor must incorporate some sort of automatic choke that will deliver an extremely rich mixture for cold-engine starts, but that choke must shut off automatically as soon as the engine warms up. The carb must provide a momentary squirt of extra fuel any time you punch the accelerator to pass, or the engine will stumble.

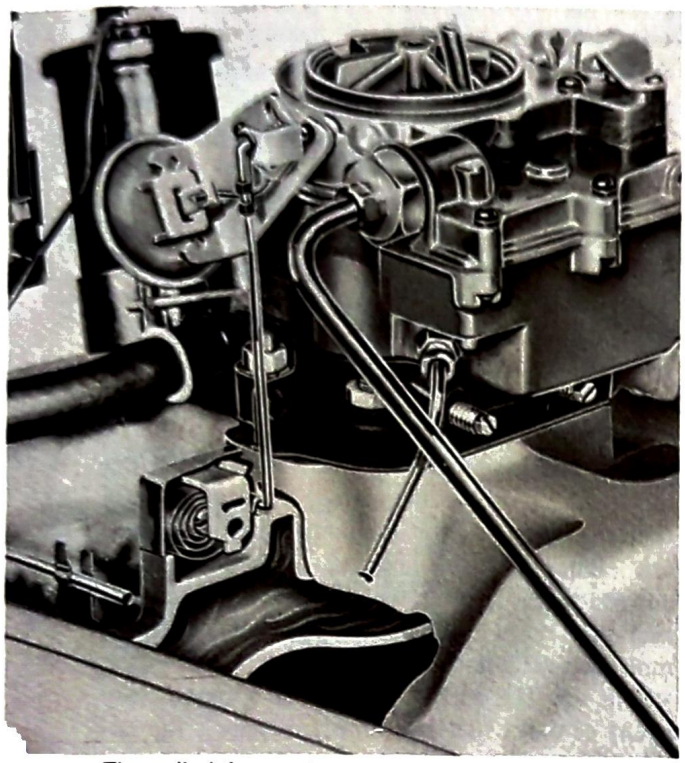
And, of course, any commercial automotive carburetor must be as simple, inexpensive, and reliable as possible.

Taken altogether, you'll concede that this gadget has a big order to fulfill.

carburetors were crude

The earliest cars had unbelievably crude carburetors. Fuel was metered through a needle valve into an air tube leading to the cylinders and was fed from a tank above the carburetor. It flowed by gravity into a float bowl that acted as a reservoir for the needle valve. There wasn't even a "venturi" throat in the air tube to give a suction force to draw the fuel. It just dribbled in. The mixture was adjusted manually by turning the needle valve. Carburetion was "right" when the engine would run!

Modern carburetors for small gasoline engines —outboard motors, lawnmowers and chain saws —aren't much more complicated. They generally use float bowls and venturis for suction metering. But the basic air-fuel mixture is adjusted by a needle valve. Sometimes there are two discharge holes in the air passage—one below the throttle valve (when it's closed), the other uncovered by



The coiled thermostat senses manifold heat and shuts off the automatic choke when the engine is warm

ABCs of carburetion, continued

the valve as it is opened wider and engine speed increased. The primary hole, fitted with the needle valve, controls idle and low speed; the secondary hole has a fixed jet, or orifice, calibrated to meter a certain air-fuel ratio.

Engines that have to operate in different positions (e.g., a chain saw) dispense with the gravity-fed float bowl and spray the fuel into the cylinder(s) under pressure from a vacuum-operated fuel pump. A venturi is used to get a suction "signal" to control a fuel metering valve.

We can get away with these relatively crude carburetors on small engines because they don't have to operate efficiently over a wide range of speeds and loads. But an automotive carb must be flexible.

Auto engineers recognized this 50 or 60 years ago. Liquid fuel and gaseous air follow different physical laws as they flow through the carburetor —air can compress and expand, fuel cannot. Thus, when air flows through the venturi throat to create a suction, its pressure drops and it expands, it becomes less *dense*, and weighs less per cu. ft. As more air flows through the venturi, the vacuum at the throat increases and air density drops even more. Meanwhile, the fuel doesn't know this. Its nozzle and jet continue to meter the same volume of fuel for each cu. ft. of air going into the engine. Result: With a simple carburetor, the air-fuel mixture gets *richer* as the throttle is opened wider. This, of course, would never do for an auto engine at cruise speeds.

fuel is metered

Modern carburetors solve this problem by metering the fuel required over three different speed ranges. The first is for idling and very low speeds; the second, a main metering circuit, is for cruising; the third is a "power" system giving that extra-rich mixture necessary for maximum power (around 12-to-1 air-fuel ratio). The fuel inlet for idle, through the side of the throttle barrel below the butterfly, feeds fuel only at idle and very low speeds, when the throttle is nearly closed. The high vacuum in the manifold actually sucks fuel out.

At cruising speeds, with larger throttle openings, the main metering circuit takes over, feeding fuel from a nozzle in the venturi throat. The fuel is controlled by calibrated jets in the circuit. Then, at full throttle, the "power" system provides the necessary rich mixture by opening a vacuum-operated fuel valve or by moving a metering rod in a fixed jet.

squirt for acceleration

Another modern carburetor feature is the accelerator pump. If you open the throttle quickly, it trips a plunger in the carburetor that squirts a shot of raw fuel into the manifold to give a rich mixture to keep the engine from balking.

One of the toughest problems for a carburetor designer is how much capacity—total venturi area—to use for a given engine. For maximum power we want big carburetor throats and lots of 'em to minimize breathing restriction at high engine speed. But when cruising at low speed, all this venturi area would actually *hurt* performance. Air velocity through the throats would be so low that throttle response would be sluggish, gas mileage would drop off, and even engine torque would be lessened.

Auto engineers have tried to get around this

offer to "tune and set" your carb for better performance and economy, don't expect much.

The only basic "tuning" that can be done outside the carb is adjustment of idle mixture and idle speed. These adjustments only affect idle smoothness and fuel economy on the idle circuit up to 10 or 15 mph. Overall richness of the carburetor can be varied somewhat by going inside the carb body and adjusting the float level. However, this is preset at the factory and should not need adjustment for the life of the car.

most common complaint

Actually the most common cause of complaint on modern carbs is a sticking choke valve—a butterfly valve in the top of the carb inlet. Closed, it cuts off the air supply, meaning engine suction will pull a very rich fuel mixture through the main nozzle. Obviously, if this valve doesn't open wide when the engine warms up, you will be running on a continuously rich mixture. The result will be very low gas mileage. If your mileage suddenly drops radically, check this first.

Just lift the air cleaner off when the engine is running (and fully warmed up) and you can see the choke butterfly in the top of the carb. It should be straight up and wide open. Another sign of a sticking choke butterfly is a dark smoke pouring out of the exhaust at idle or low speeds. A sticking choke can be freed by applying a little light engine oil to the ends of its cross shaft. If the choke isn't actually sticking, but still isn't opening properly, you'll probably have to replace the controlling thermostat unit.

system causes problem

Another common poor-running problem on some '62-'65 models—often blamed on the carburetor—is caused by the anti-smog crankcase ventilating system. Such systems are designed so carburetor suction draws "blow-by" gases from the crankcase back into the manifold to be burned in the cylinders. But if the little valve in the suction line should stick shut, the carb will run very rich because it was calibrated to run with extra air from the crankcase.

It's a simple matter to clean the valve in solvent or replace it.

Your carburetor is one component on a modern automobile that should require no complicated maintenance for the life of the car. Just check idle speed and mixture now and then and see that the choke valve is kept free and working.

The venturi—carburetion key

BY ED NELSON

■ THE FAMILIAR EXPRESSION, "Still water runs deep," and its corollary, that "Shallow water is usually faster moving," can be the key to understanding the principle of flow in the carburetor venturi area. And the flow in the venturi area of the carburetor throat is the key to the carb's entire operation.

When the course of a deep but slow-moving stream reaches a shallow area, the water must speed up in a "miles-per-hour" sense, even though the number of gallons passing a given point doesn't change.

Venturi action is similar. Where available carb throat area narrows, the speed of flow increases sharply. And here's the critical point: As the speed increases, the air pressure within that section of the throat is reduced importantly.

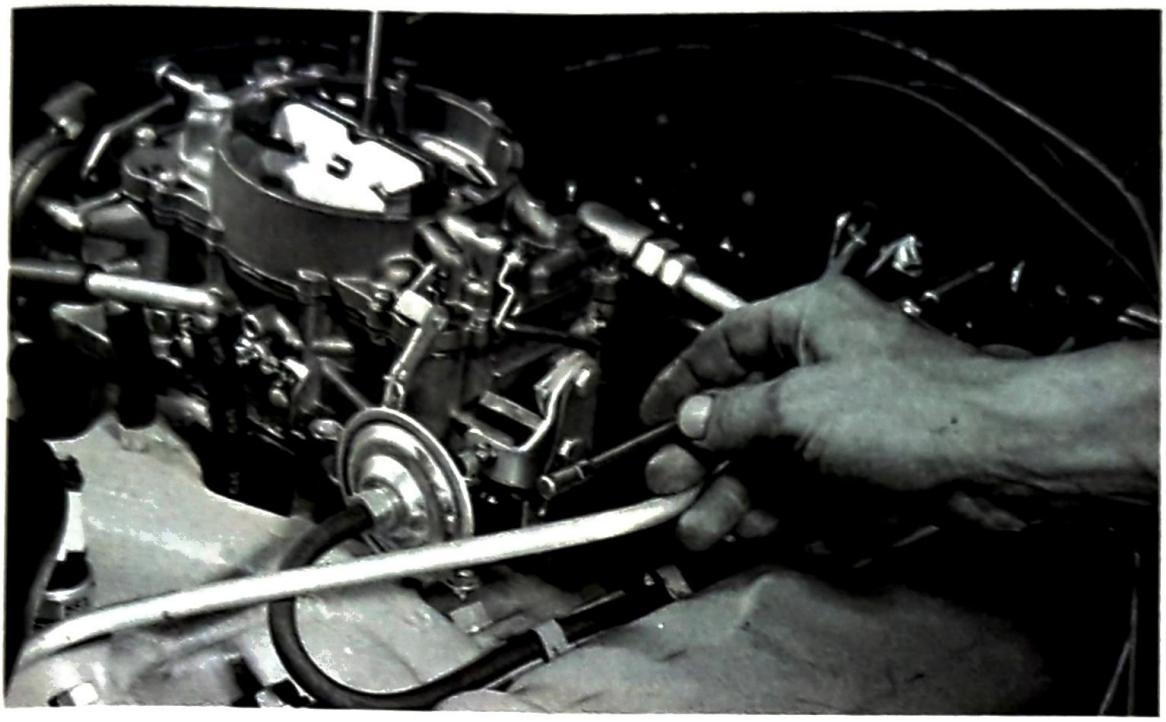
This is where gasoline from the carburetor float bowl comes into the air stream through the main fuel nozzle. Normal atmospheric pressure in the rest of the system sends fuel into the partial vacuum.

The diagram on page 468 seems to show an exception to this rule: The idle jets are down close to the throttle plate. But don't let this confuse you. The throttle plate itself performs the venturi function in this case—when it's practically closed off.

When you're sitting at a stop light, the amount of air flowing down through the carburetor throat is low—too low to pull fuel in adequate amounts through the main nozzle. But, since there's only a small gap around the edges of the throttle plate, the flow there is high in speed (although low in volume). There's a substantial venturi effect—and a corresponding pressure drop. The partial vacuum, with manifold help, draws fuel from the idle jets into the high-suction area.

When you open the throttle to pull away from that stoplight, the gap at the edge of the throttle is, of course, enlarged. Flow speed around it is reduced, hence the pressure drop is soon gone. The idle jet gradually stops feeding gasoline into the air stream. But, while this is happening, the amount of air coming down through the main venturi is increasing sharply. And that means that fuel is flowing into the air stream from the main nozzle.

See also: carburetors, outboard; chokes, auto; fuel consumption, auto; idling, auto; spark plugs, auto; starting, auto, cold weather; starting, auto, hot weather.



Should you lay a hand on your carburetor?

BY MORTON J. SCHULTZ

Some mechanics suggest that only an expert should try to clean or adjust these vital units. But appropriate maintenance can avoid an overhaul

■ FOR MANY MOTORISTS, do-it-yourself maintenance screeches to a halt when they confront the carburetor. And there's good reason to be wary of upsetting the balance engineered into this vital part of the car.

Functioning as your car's respiratory system, it must gulp in a measured amount of air for each drop of gas. If the mix proportions are disturbed, the engine can't breathe properly.

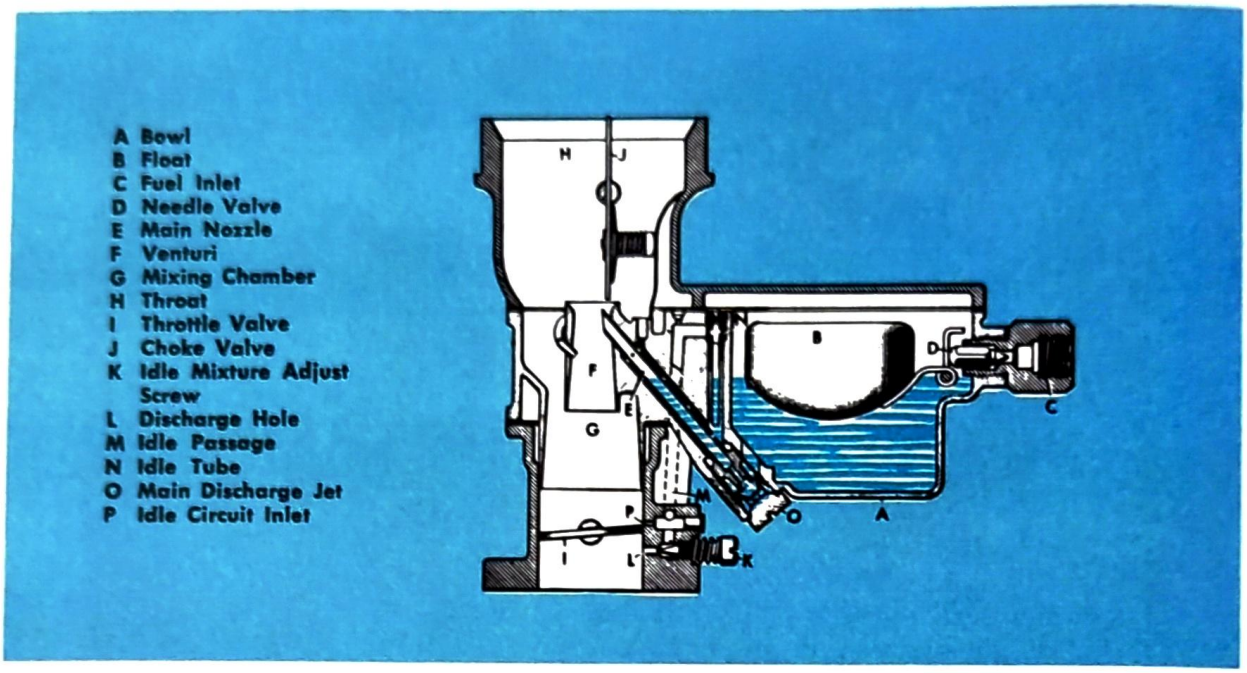
Carburetors are big business. Nearly 11 million units a year are overhauled and more than 15 million replaced.

Clearly, then, the carburetor gets the blame for a huge share of car trouble. And it looks like few auto owners do their own work in this area. There isn't much doubt, either, that many of those 26 million carb jobs involve needless overhaul and replacement. The owner who takes neither the time nor trouble to understand his carburetor leaves himself wide open to a big repair bill when the real cause of his trouble may have been minor.

Carburetors used on today's high-compression engines aren't the easiest part of the car to understand. But neither are they beyond the layman's ken, as the pros may insist.

With only rudimentary knowledge of how a carburetor works and how it can be maintained, you can often pinpoint the trouble. At least you can call the likely area to your mechanic's attention. This may save you the cost of unneeded parts and labor.

First, consider the carburetor's operation and the maintenance you can perform without re-



your carburetor, continued

HOW A FLOAT VALVE OPERATES

To keep the fuel in the bowl at a constant level, so it neither overflows nor sinks too low, a needle valve is placed at the fuel inlet. This valve is controlled by a float a lot like one in a toilet tank: As gas gets low, the sinking float opens valve (left above). As the bowl fills, the rising float closes the valve. A four-barrel carburetor has separate floats for the primary and secondary circuits, but single- and two-barrel carburetors have only one float system, The float's relationship to the system is shown at the top

moving it from the car. Later, more extensive troubleshooting, overhaul and adjustment will be covered.

The carburetor's job is to mix air and fuel in the proper amounts and deliver this mixture through the intake manifold to the combustion chambers. Proper balance of the air-fuel mixture is vital; otherwise a host of problems can arise, such as flooding, hard starting, stalling, rough idle, fouled plugs and poor gas mileage.

Basically, a carburetor consists of only two major units: the bowl, or chamber, and the throat, or air horn. The bowl is just a reservoir that holds gasoline until it's needed. A constant level is maintained.

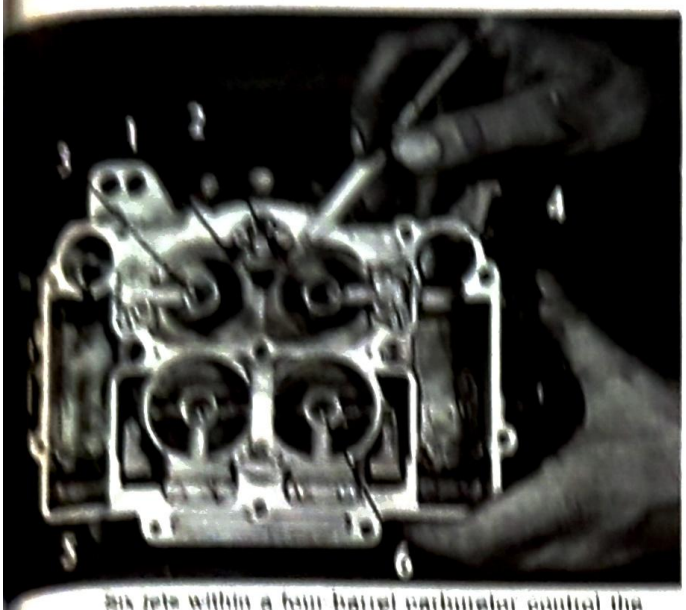
The throat is where gas and air are blended. The gas flows from the bowl up a nozzle extending into the middle of the throat's narrowest part, called the venturi (see sketch above). As the pistons in the engine move down, they create a vacuum in the throat that brings air rushing in at speeds approaching 250 miles per hour. The speed is highest, and the vacuum greatest, at the narrow opening of the venturi. Normal atmospheric pressure on the surface of the gas in the bowl sends fuel up and out of the nozzle into the throat as shown at the top of page 476.

Gas pouring into this fast-moving airstream is broken into a fine spray that mixes with the air. The mixture rushes down the throat into the intake manifold and on through the valves into combustion chambers where the spark plugs ignite it.

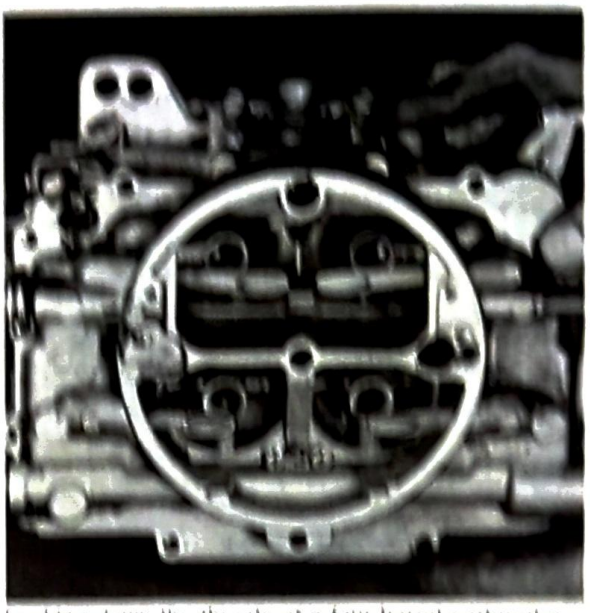
Simple? Yes, but our requirements for quick engine pick-up, high- and low-speed efficiency, ease of starting, and smooth idling all demand refinements to the simple, basic carb.

To get varied fuel flow and varied engine speed, a throttle valve (or valves) is inserted just above the entrance to the intake manifold. The accelerator pedal opens the throttle and passes more of the air-fuel mix to the combustion chambers. Coming off the pedal virtually closes the throttle—and throttles the engine's efforts to breathe.

And to let the engine idle, you actually need a richer mixture than is required for cruising speed. The charge density is low and the combustion chamber at each intake stroke is still



Six jets within a four barrel carburetor control the fuel flow from bowl to throat, or bypass, preventing flooding. Four of them feed the primary circuit and two supply fuel to the secondary barrels



Looking down the throats of a four barrel carburetor, it is easy to distinguish the two basic sections. The top barrels, normally covered by an air valve plate, are secondaries; primary barrels are at bottom

A clogged air filter acts in the same way as a partially closed choke valve and can easily cut your fuel mileage by 10 percent. Old filters could be cleaned, but the current ones are designed for replacement once they have become dirt clogged

somewhat contaminated with exhaust products left over from the previous firing, so combustion conditions are far from ideal.

The idling system involves a bypass tube bringing fuel into the throat well below the venturi and just below the edge of the throttle valve. It provides enough air and fuel to keep the engine running (second sketch, top of p. 476).

A further refinement to the basic carburetor is today's accelerator pump (photo, bottom of p. 476). When you lean on the gas for fast acceleration, you open the throttle and air rushes immediately down the carburetor throat. But there can be a slight lag in the slug of added fuel that follows the air, since it is heavier than the air and moves more slowly. The engine would stumble and you'd experience "flat-spot acceleration" if not for the accelerator pump; it gives you one critical squirt of fuel to get the engine over its flat spot.

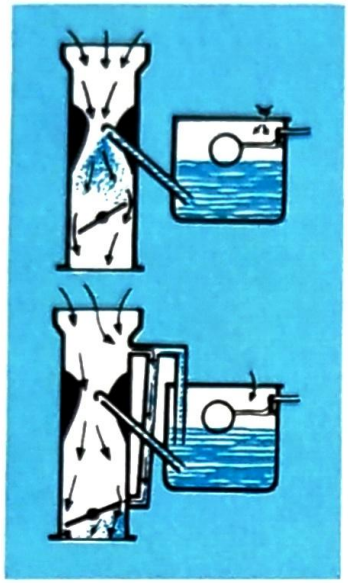
The pump is linked to the throttle and forces an extra charge of gas into the air stream during the time the throttle is actually opening. This pump also provides an extra shot of fuel when you floor the accelerator to start the car.

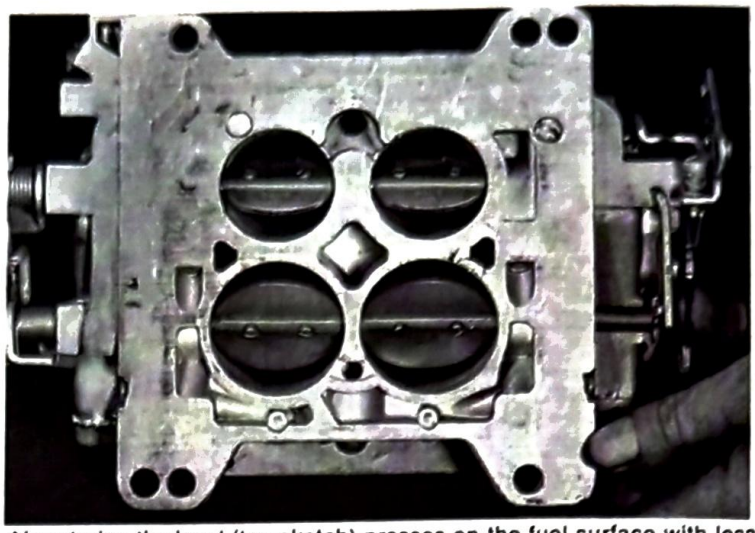
During starting, the modern carburetor's automatic choke also comes into play. The choke plate looks much like the throttle plate, but is located at the top of the throat instead of the bottom. When it closes, even partially, the suction applied by the piston moving down in the cylinder acts to pull extra gas into the carburetor throat, the supply of air being choked off. Fuel is much more reluctant to vaporize in a cold engine, particularly when cylinder walls are cold, too. Since only the most volatile fuel components will turn to vapor, a great increase in the total amount of fuel is required.

When the engine reaches running temperature, a thermostat opens the choke to admit more air and bring the air fuel ratio to normal.

These, then, are the essential parts of today's carburetor. Manufacturers, however, add other parts to fulfill special requirements.

These include economizers, anti-percolation passages to let boiling gasoline vapor escape, a built in screen at the fuel inlet to help keep dirt out, choke modifiers to prevent overchoking due





Air entering the bowl (top sketch) presses on the fuel surface with less strength than the lower-pressure air in the venturi, so fuel flows through the nozzle into the throat. With the throttle closed (lower sketch), the bypass feeds the idling engine. The photo above shows the paired throats of a four-barrel carb. Larger throats are reserved for maximum power

your carburetor, continued

ing warm-up, idle compensators to let extra air into the throat during the hot-idle conditions, and dashpots (on most cars with automatic transmissions) to close the throttle slowly when you come off the pedal sharply.

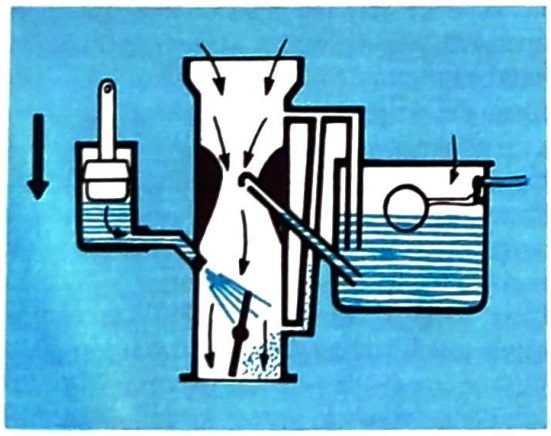
Most late-model cars have two- or four-barrel carburetors. But the principles of the single-barrel carburetor explained here apply equally well to multi-barrel units. Although operation of the two-barrel carb is identical to that of a single, its four-barrel big brother differs.

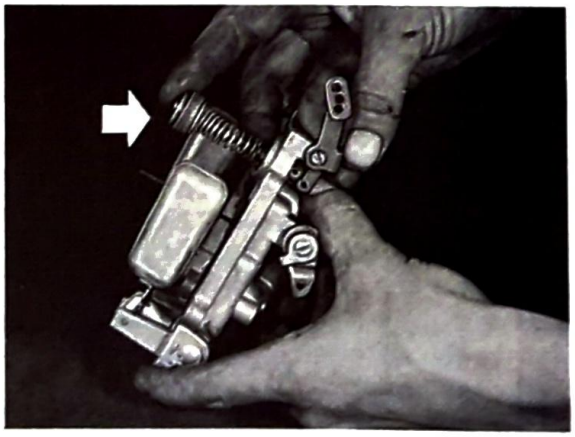
The four-barrel carburetor is divided into two sections as shown on page 475. The two primary barrels supply all fuel to the engine at idle and up to about ¾ of full throttle. Then the two secondary barrels cut in with the additional fuel and air required. This secondary or high-speed section is usually activated by a vacuum-operated device that opens or closes the secondary throttle according to the engine's fuel requirements.

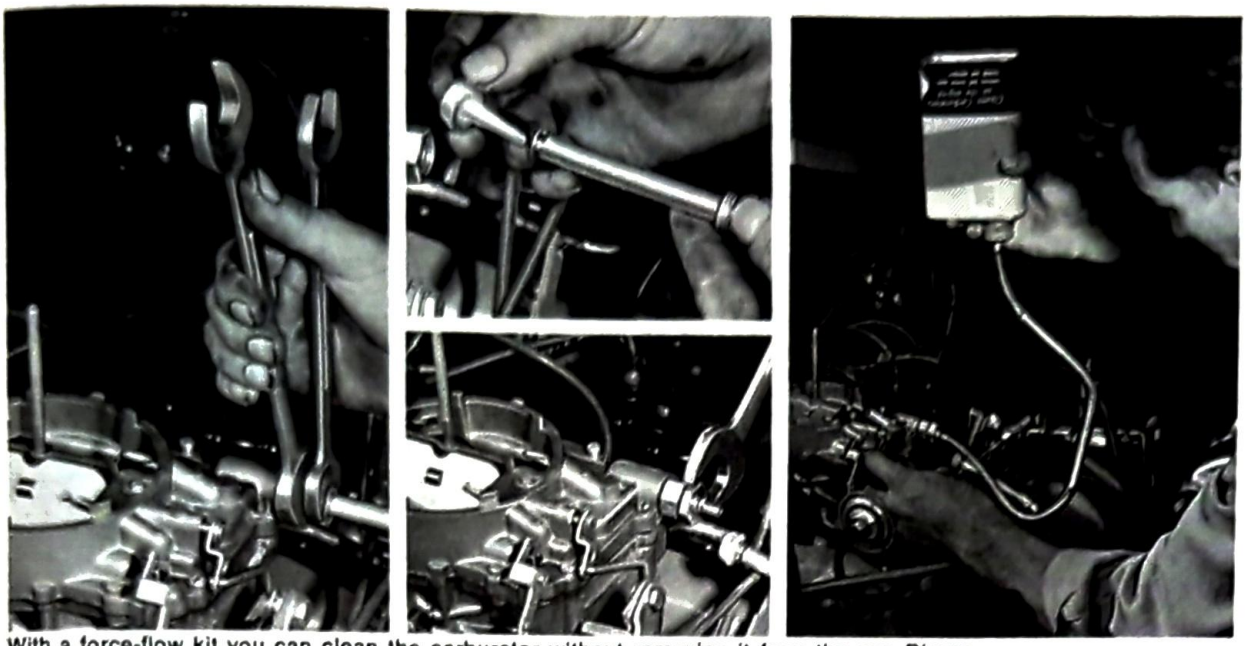
Some engines—the really souped-up models—have two or even three four-barrel carburetors. Each supplies a portion of the cylinders with fuel. They are linked together mechanically to provide a smooth, uniform fuel supply.

What are the results of poor carburetion? Aside from the immediate effects such as flooding, stalling, rough idle and hard starting, poor carburetion affects engine life in two ways. First, if the mixture is too rich—if there's too much fuel—gas will deposit on cylinder walls and wash away oil. In addition, gas will run down the cylinder walls into the crankcase where it will dilute oil.

The accelerator pump (indicated by the arrow in the photo) delivers an extra shot of fuel for pick-up. The pump moves downward (arrow in sketch) to force the squirt of gasoline into the carburetor's throat. Otherwise the heavier fuel couldn't respond to the accelerator pedal's demand as promptly as the lightweight air could. The results would be stumbling acceleration







With a force-flow kit you can clean the carburetor without removing it from the car. Disconnect the fuel line from the carburetor (left) and plug it (top center) with the kit's block-off adapter. Turn the kit's universal adapter into the fuel inlet (bottom center) and attach the plastic hose. Start the engine and pump the throttle

The second effect of bad carburetion is quicker and more devastating. With an over-weak fuel mixture, preignition can occur. When the mixture entering the cylinders is too low in gas, it burns hotter than normal. Hot spots created in the combustion chambers can cause premature firing of the mixture.

This premature firing occurs while the piston is still on its way up and results in extreme pressure on that piston. For that reason, cracked pistons are less rare than they should be in today's engines.

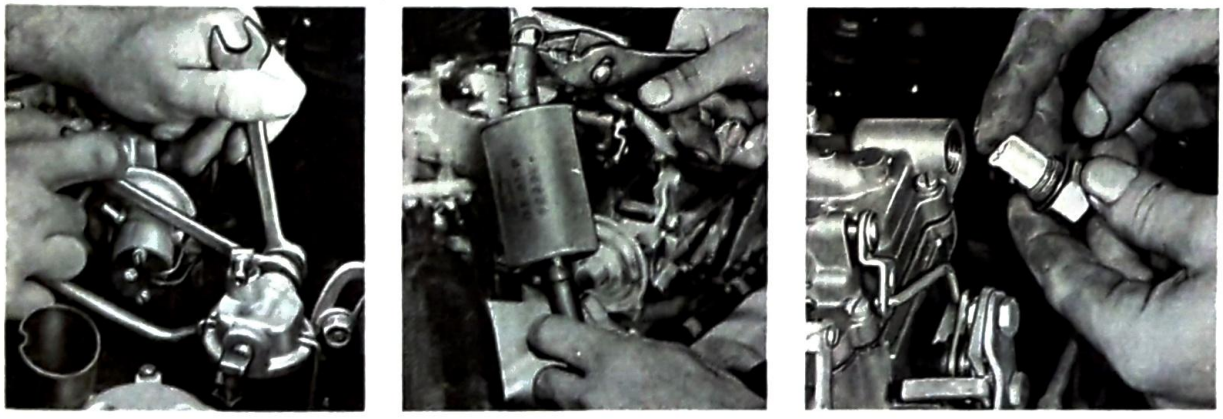
Preignition can also cause excessive piston-ring wear. When preignition takes place, most of the lubricant on the cylinder wall has either been evaporated or burned away because of the extreme temperatures in the chamber. Thus sufficient heat can be generated between the two surfaces—rings and wall—to weld the parts together, often resulting in a destructive seizure.

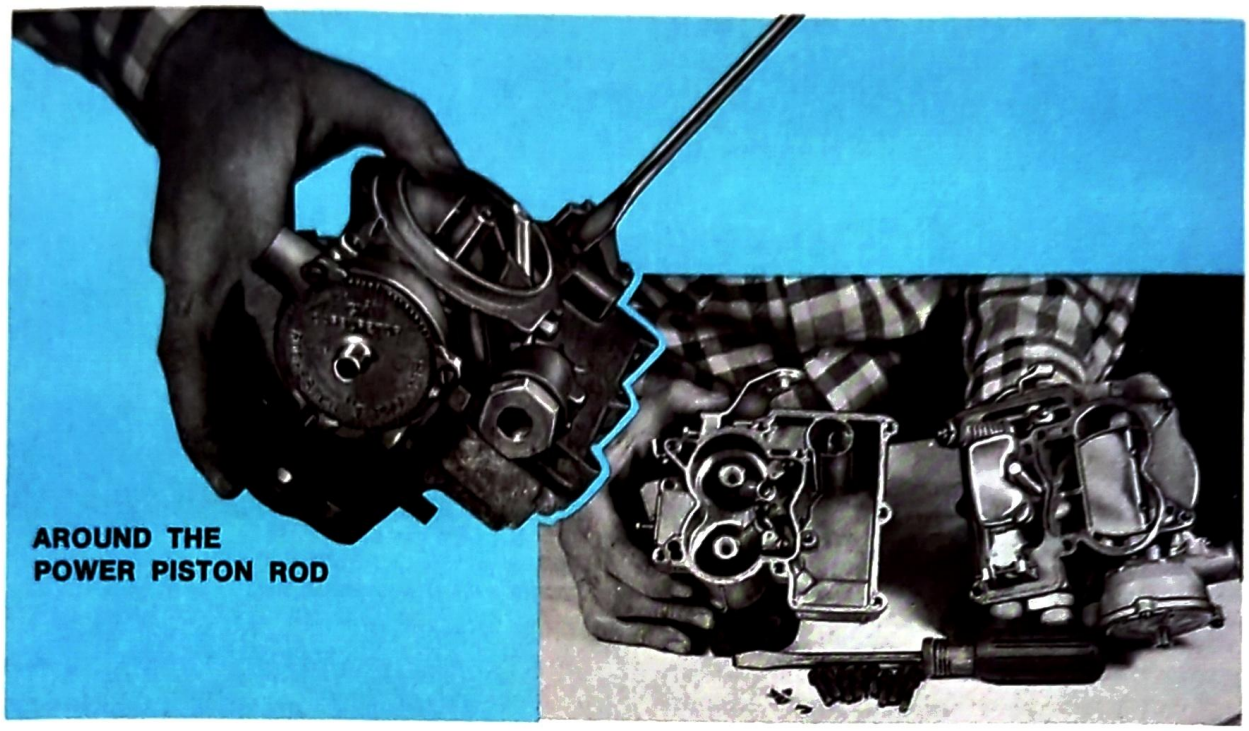
Dirt is the chief cause of poor carburetion. If it weren't for dirt, chances are that a carburetor would operate efficiently for the life of the car with only rare adjustment.

Dirt in carburetors takes two forms. One is road grit, dust and water that get into the carburetor with fuel and intake air. The other is gum that forms inside the carburetor.

Whatever its form, dirt plugs up or partially blocks passages. This upsets the calibration and leads to the delivery of unbalanced fuel-air mixtures to the engine.

The in-line fuel filter should be removed. The old type (left) went out in 1963; they could be cleaned and reused. The one at the center must be replaced; follow manufacturer's recommendations. At the right is the filter screen from the fuel inlet port. It usually supplements the in-line filter, but can be removed, cleaned in carburetor solvent, and reinstalled





your carburetor, continued

Road grit can also prevent the needle valve from closing; that means flooding. It can cause wear on such parts as the needle valve and seat, accelerator pump, jets and small passages as well.

There are several ways to get rid of dirt. The most effective—and the only method to use if the carburetor hasn't been cleaned for some time—is to remove the unit, dismantle it, and clean each part in solvent.

Another way is to use a forced-flow solvent through the carburetor while it's on the engine. This method is effective if you start carburetor cleaning early in the life of a car and keep it up periodically—say once every 5000 miles.

The first step in the forced-flow method is to warm the engine to operating temperature. Then take off the air cleaner. As you do this, check the filter for dirt. It should be replaced about every 12,000 miles.

Now follow the steps shown in the photos at the top of page 477, using parts from a force-flow kit. One can be purchased in any good auto-parts shop; just be sure you get one for internal carburetor cleaning, not external. To be certain the fluid reaches all the passages and air bleeds, cover the carburetor throat with your hand now and then to choke the unit.

How do you know when your carburetor needs work? Every mechanic, from the specialist to the home-grown weekend tinkerer, has his own answer to this question.

The truth is you're never really sure a carburetor needs tuneup. Everything may point to a carburetor-caused condition, but the real trouble may be in some detail you overlooked elsewhere.

Don't misunderstand: Figures indicate that bad carburetors are high on the list of trouble causers. A defective carb still can mean hard starting and flooding, rough running and surging, flat spots, hesitation, and balks on acceleration, sick gas mileage, backfiring, fouled spark plugs, rough idle or stalling. But any one of these could be symptoms of trouble other than the carburetor. That's why you do carb work *last*. Don't make your carburetor a scapegoat for every engine malfunction.

But assume you've more or less isolated your trouble at the carburetor. How do you bring about the cure? The approach can be summed up in three words: *clean, replace, adjust!* One should never be undertaken.

It's foolish, for example, to adjust a dirty carburetor—your adjustments can't be accurate. It's just as foolish to clean a carburetor but not adjust it. And who would clean and adjust a carburetor, but leave worn parts in it?

To describe these jobs specifically for each carb made isn't practical here. The breakdown, parts replacement, and cleaning procedures are quite similar from carburetor to carburetor, it's

true. But many parts aren't standardized and adjustment procedures and specifications can vary.

Instead, here's a study of a typical carburetor, the Rochester two-barrel job on many General Motors cars. Its overhaul will show that the job isn't as tough as it looks. With a step-by-step procedure to follow, nearly anyone can service his own carburetor.

One learns best by doing. Get an old carb (preferably the same model as your own) from a junkyard or mechanic friend, and tear it down part by part.

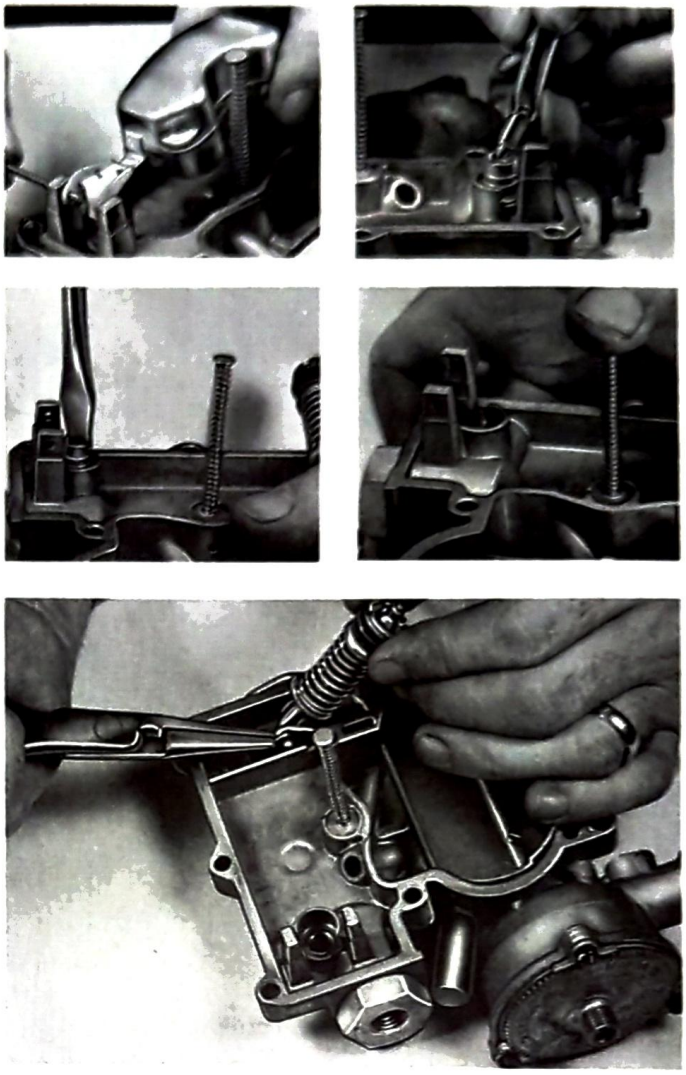
Eventually you'll want a tuneup kit, so you might as well get one early. Simple kits for one and two-barrel carbs cost about $4.50; those for a four-barrel unit about $6.50. And you may well find the kit includes all the adjustment specs you need. Otherwise look for a service or tuneup manual for your model. Try the local library or a friendly service station or write the manufacturer, giving the model number from your carb.

If your carburetor is fairly new and you've cleaned it periodically by the force-flow method, you can forget off-the-car cleaning and just make the adjustments. But no matter what affectionate care you've given it, your unit should get the full treatment after, say, 30,000 miles.

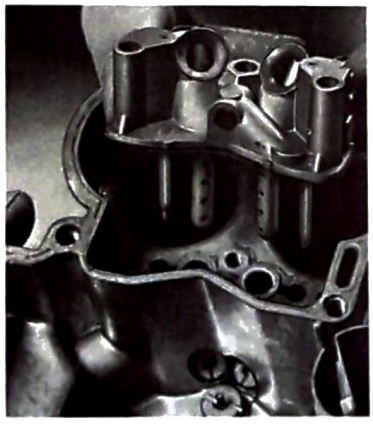
Your repair kit will contain the items that wear fastest, like the needle-valve assembly, accelerator pump plunger, and all gaskets. It's wise to replace all these while you have the carb torn down. But always check the repair kit before discarding old parts during reassembly, to be sure replacements are available.

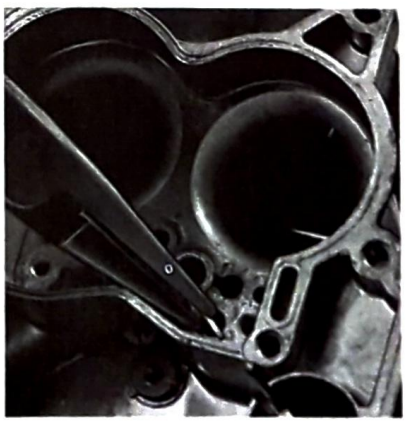
Jets, venturi cluster, or idle-mixture screws may not be in the kit, but they can be bought separately. Or, if you plan a complete overhaul, get an overhaul kit—at about double the price of a simple tuneup package.

Most tuneup kits include a combination gauge

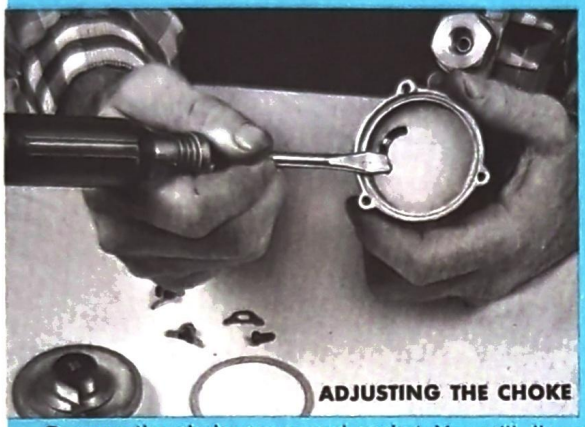


After splitting the carburetor in two (facing page), start on the parts near the rod. Remove the float hinge pin (top left), then the bowl gasket and needle valve from under the float arm (top right). Unscrew the slotted needle valve seat (center left) and discard both it and the filter screen beneath it. Check the piston rod (center right) and replace it if it binds. Then remove the accelerator-pump plunger (directly above). Shifting to the air-horn section, remove the pump-plunger spring (below left), unscrew the venturi cluster (below center), then remove the tiny T-shaped retainer beneath it (below right) to open the pump discharge circuit. This will enable you to spring the ball or needle valve in this area



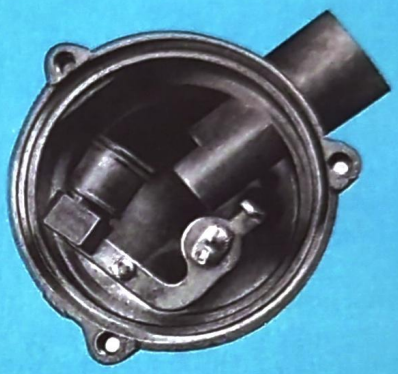


Unscrew the throttle assembly from the air horn and check the threads on the idle mix screws. They should be replaced if the threads are stripped or corroded



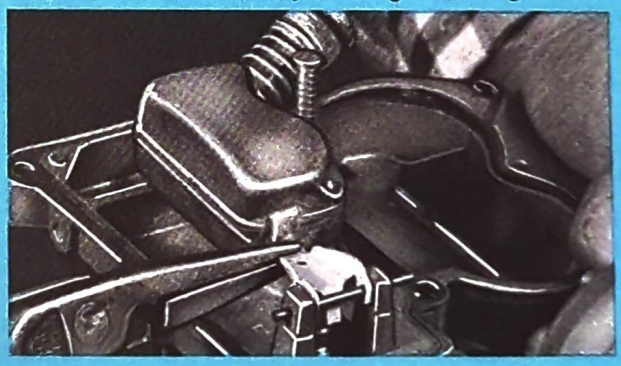
ADJUSTING THE CHOKE

Remove the choke cover and gasket. You will discard the gasket, but lay the cover aside (lower left) to remind you not to dunk it in cleaning solvent (because of its thermostat). Then remove the slotted cover found inside, in order to get at choke piston. On this model, slide the assembly off to remove the piston

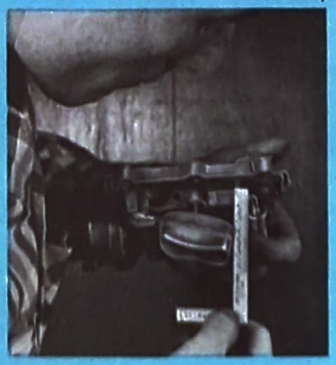


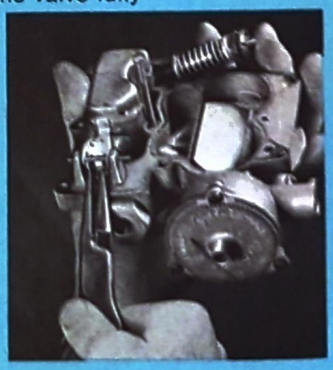
ADJUSTING THE FLOAT

All float adjustments must be precise, so use the gauge made for your carburetor. Deviations from manufacturer's specifications could cause either flooding or fuel starvation. Gauge rests on the gasket when you check level (left). Adjustments are made by bending float hinge



For the float drop adjustment, hold the bowl so the float hangs free (left); the top of the float should align with a mark on the gauge. If adjustments are needed, bend the tang slightly toward the float itself to raise the level, and away to lower the level. The float must be able to drop properly when fuel level falls in order to open the valve fully





for adjusting float drop and level, and accelerator pump height. Or you can buy separate gauges from your auto-parts dealer for a few cents. Just be sure you get those for your model carb.

After disassembling the unit as shown on page 479, test the float for leaks. Submerge it in water for a few minutes, then shake it next to your ear. A sloshing sound means it must be replaced. Other checks are mentioned in photo captions. In some carburetors, there are one or two metal checkballs beneath the pump-plunger coil spring. Shake these out by inverting the assembly and rapping it into the palm of your hand. They're small, so take care not to lose them.

The power-piston valve is the large one between the two jets. Remove it and test it by pressing the plunger in the valve's center. If it binds, replace it. Then remove the jets and examine their threads. If they're stripped, get new jets, but be sure not to change their size or you'll upset carburetor balance.

Take all the parts you've removed and the casings and dunk them in carburetor cleaning solvent. To simplify cleaning, fashion a wire basket to fit into the receptacle holding the solvent. Let the parts stay in the cleaner for several hours and agitate every half hour to be sure the solvent penetrates all passages.

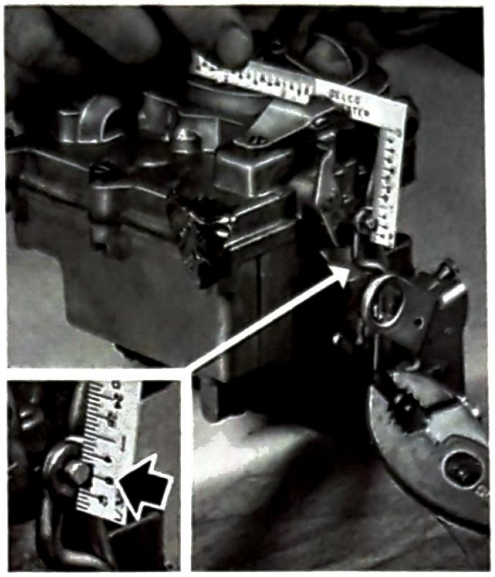
After cleaning, blow out parts and casings with compressed air. This serves two purposes: to hasten drying and dislodge all loosened dirt inside the passages. If you don't have, and can't get the use of a compressed-air supply, forget about cleaning your own carburetor and let a specialist do it. There's no sense in loosening dirt, only to let it sit there and harden again.

mistakes to avoid

Whatever you do, never stick wire down into passages in an attempt to get dirt out, since you could scratch the finely calibrated surfaces. And never wipe parts or the inside of casings with a rag. Lint and threads could stick to them and eventually cause trouble.

Five adjustments to be made on *any* carburetor are shown in the photos with this article: the choke, float, accelerator pump, idle speed, and idle mixture. (Some carbs require additional adjustments, discussed later.)

After your carburetor is clean, reassemble it (reversing the disassembly sequence), installing new parts from your repair kit as you go. Before attaching the air horn to the bowl, you should adjust the float for level and drop as shown on page 480. Then complete assembly of the carb.



Adjusting the accelerator pump also requires a gauge. Turn the carburetor over to be sure the valves are closed (and back the idle screw from the fast-idle cam if needed).

But before putting it back on the engine, adjust the accelerator pump—actually, the length of the accelerator pump stroke.

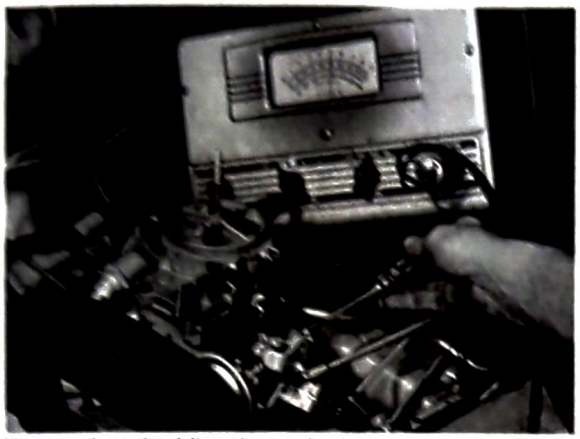
Your other adjustments are made with the carburetor back on the car. When you hook up a tachometer for the idle-speed test (top left, p. 482), make sure the fast idle screw is *off* the high step of the fast-idle cam if the car's equipped with automatic transmission.

Single-barrel carburetors have a single adjustment screw for the idle *mixture*. Two- and four-barrel carburetors have two. The rear two barrels of most four-barrel units are for high performance only and don't have an idle system.

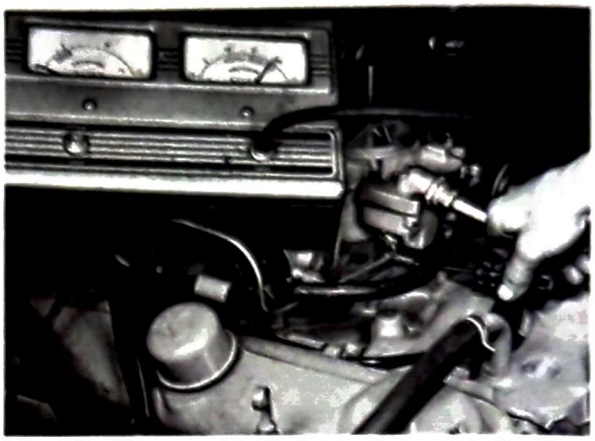
When the idle mixture is adjusted for smoothest idle and highest engine vacuum, go back and check idle speed once more with the tachometer. You will probably find that idle speed has picked up considerably, so bring it back within specifications again. Then go back and readjust the mixture and keep alternating between speed and mixture until both are properly tuned.

Manual chokes require only a positioning of the cable to make sure the choke plate is closed in the carburetor throat when the choke button is pulled out inside the car. When the button is pushed in, the choke should open.

To adjust this, have someone hold the choke button in. Loosen the screw on the clamp that holds the cable-to-carburetor bracket. Position the choke plate straight up and down in the carburetor throat and tighten the screw. Check choke adjustment by operating the cable several times. Usually, if the choke plate is properly po-



Next, adjust the idle mixture for smooth running. With the vacuum gauge hooked up, adjust the screw or screws for the peak vacuum-gauge reading



Adjust the idle speed (with the engine warmed) using a tachometer. Turn the speed adjustment screw in or out until the tach shows the recommended speed

your carburetor, continued

sitioned in the open position, it'll be okay in the closed position.

With automatic chokes, you adjust the housing cover (bottom photo, p. 482). Though some manufacturers allow the cover to be positioned one or two marks rich or lean to compensate for seasonal operation, most mechanics leave the cover and housing marks in line.

Those additional adjustments required on some carburetors include:

1. *Fast Idle:* This adjustment is made to provide easy starting of a cold engine. It involves the correct interplay between the choke and throttle valves. When properly adjusted, the choke restricts the air flow while the engine is starting (to provide a rich mixture), and the throttle valve is kept open so the engine idles faster than normal when started. The adjustment is made only on carburetors with automatic chokes.

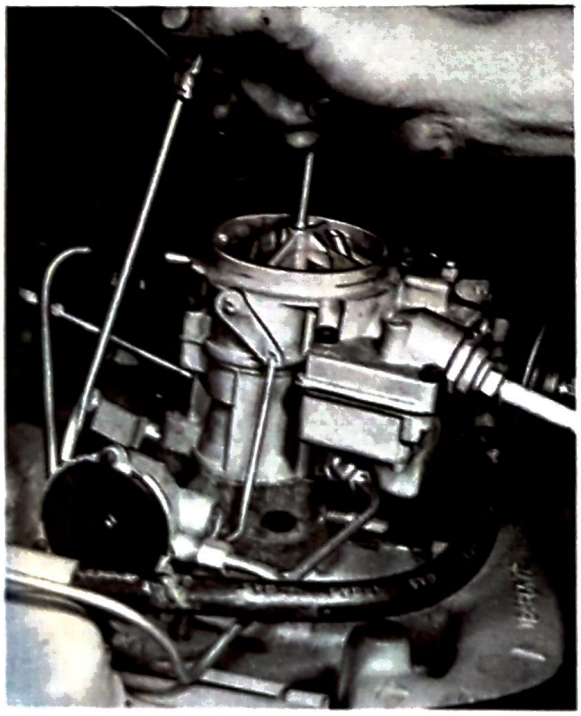
2. *Unloader:* This adjustment, too, is made only on those carburetors with automatic chokes. When adjusted properly, the unloader clears an over-rich fuel mixture from the carburetor by enabling the choke plate to open wide when the driver holds the accelerator pedal to the floor. This permits starting of a flooded engine.

3. *Anti-Percolator Device:* High under-the-hood temperature could cause fuel to boil in the carburetor. When this happens, vapor pressure builds up and pushes fuel into the intake manifold, flooding the engine. Some carburetors are equipped with an air bleed that permits this pressure to pass out of the carburetor.

4. *Dash Pots:* Most cars equipped with automatic transmissions have a dash pot to overcome the tendency of the engine to stall should the driver remove his foot too quickly from the accelerator pedal. It is connected to the throttle linkage and closes the throttle slowly to idle speed regardless of how quickly the pedal is released.

Now that everything's perking just right, it would be criminal to upset the balance of the carburetor with a dirty air cleaner—so get a new one. However, in putting the air cleaner cover on the carburetor, be careful not to over-tighten the wing-nut. This could collapse the air horn throat or impair the action of the choke plate. Tighten the wing-nut until it's just *snug*.

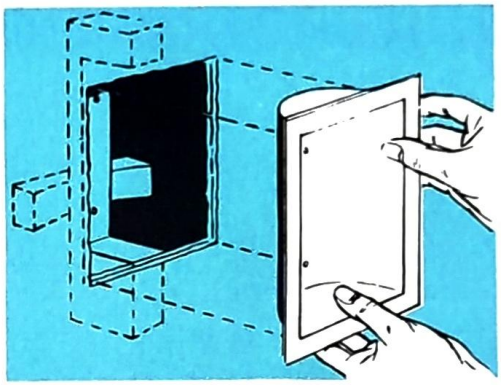
With an automatic choke, the notched cover must be positioned to match properly with the indicator on the choke housing. Some chokes vary with seasons



Slit a colorful picture to the right widths and mount it on the venetian blind in your youngster's room. Whenever the blind is closed, the picture appears like magic.

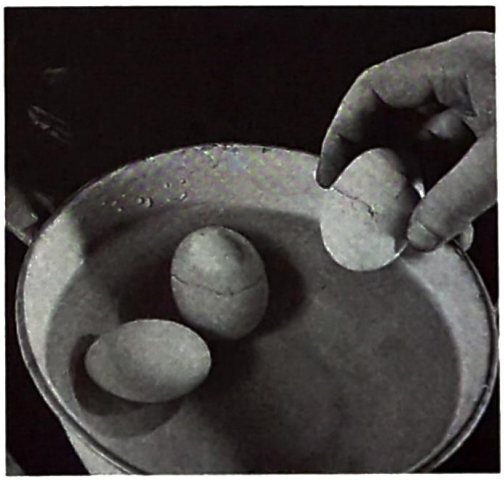
When mowing high grass, set the leading edge higher than the rear. This gives at least two cuts to each blade of grass.

A cross of tape on the F and J keys of a typewriter helps a beginner find the "home position" by touch.

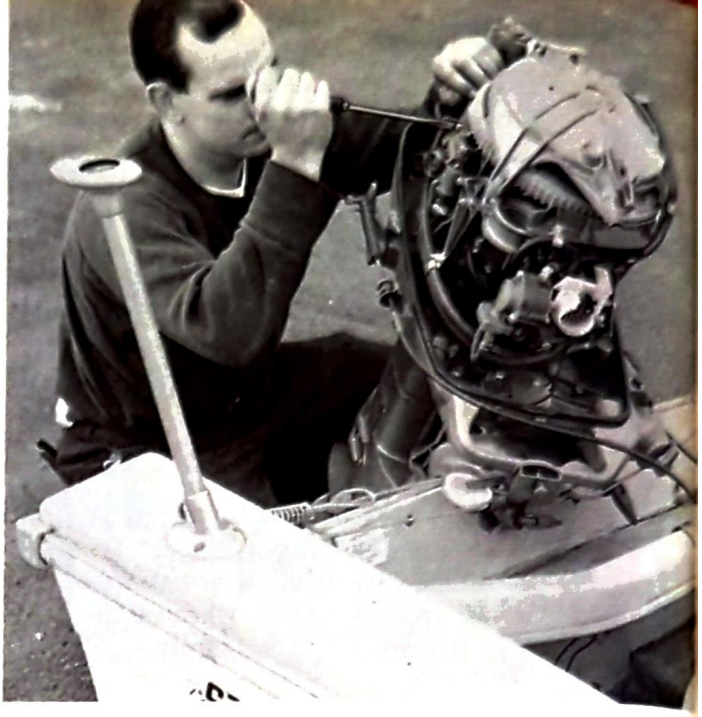


To mount a recessed bathroom accessory securely, wedge a backing block in place in the cutout. Once screws are installed, the block will be drawn up tight against the inner surface of the wall.

To seal jelly jars, cut paraffin shavings into the bottom of each glass and pour jelly into it. The paraffin will float to the top, cool, and solidify.



To prevent the contents of a cracked egg from oozing out during boiling, add a teaspoonful of salt to the water.



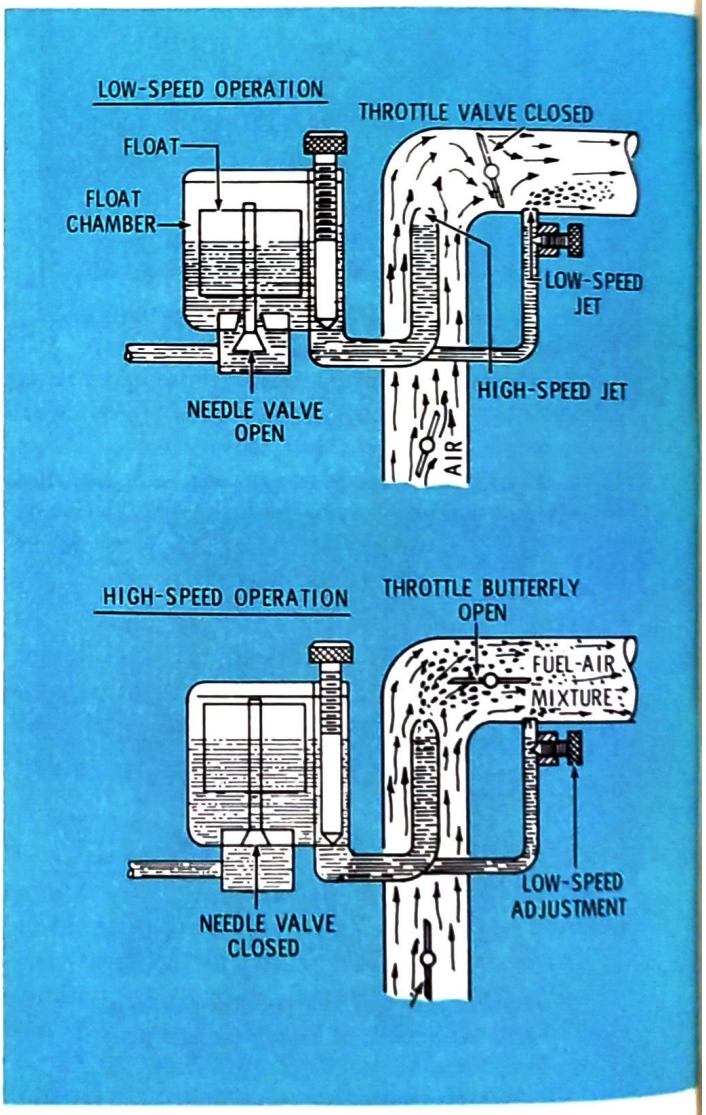
Troubleshooting outboard carburetors

BY MORTON J. SCHULTZ

Whether your outboard problem a washboard idle or a dead engine, if it can be traced to your carburetor, you can probably fix it without trouble

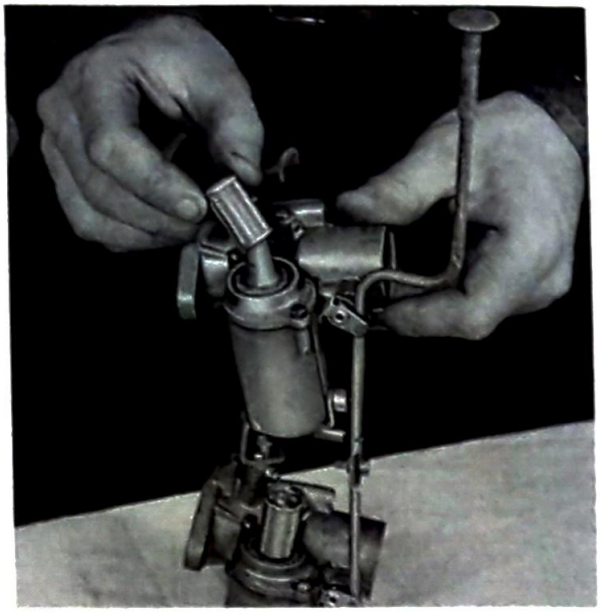
■ PITY THE POOR CARBURETOR! It's the most cussed, most worked-on-for-no-reason and least understood part in an outboard engine.

Actually, the carburetor on a small to medium-size outboard is one of the simplest engine parts to service. With the larger engines, however, it's another story entirely. Many of today's big outboards are equipped with carburetors that can almost match a hot automotive carburetor in complexity. Let's make it clear at the outset that such carburetors require the tender care of a trained mechanic, so unless you are confident of your skill, better not tamper.

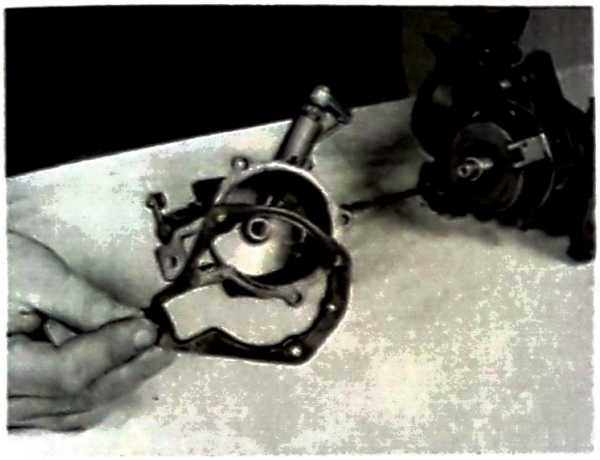


cards, greeting: see linoleum-block press
carousel: see merry-go-round

The filter on the Mercury carburetor is hidden under a cover that has to be removed for servicing



A metal filter like this one can be cleaned in kerosene and reinstalled. It rarely needs to be replaced



In some cases, the carburetor gasket can swell enough to block the fuel flow through some passages

The only purpose of an outboard fuel system is to deliver a fuel mixture to the cylinders. This mixture is pumped from the tank up through a hose by the fuel pump, which is merely a pulsating diaphragm that sucks in fuel on one pulse and pushes it out on the other. On the push-out pulse, fuel is shoved through another line directly to the carburetor fuel bowl.

But it's not a steady flow.

A sophisticated little device called a float and needle valve assembly regulates the flow, and it works like the float assembly in a toilet tank.

When you flush a toilet, water streams out the tank and the float drops, opening the intake valve. The same thing happens in the carburetor bowl. As fuel is consumed, draining the bowl, the float drops and allows the needle valve to leave its seat, opening the way for fuel to flow into the carburetor.

When a toilet tank fills with water, the float rises on the water and shuts off the intake valve when the water reaches its top level. In the carburetor, the float rises as fuel fills the bowl, pressing the needle valve against its seat.

In modern carburetors, fuel flows from the bowl into the carburetor air tube, or venturi, through a non-adjustable, fixed high-speed jet in just the right amount on which your outboard will run most efficiently. Older carburetors had metering valves that had to be adjusted.

The fuel squirts out the high-speed jet and is picked up by the tremendous rush of air going through the venturi, the result of vacuum created by the stroke of the piston. This fuel-air mixture is drawn into a cylinder and ignited.

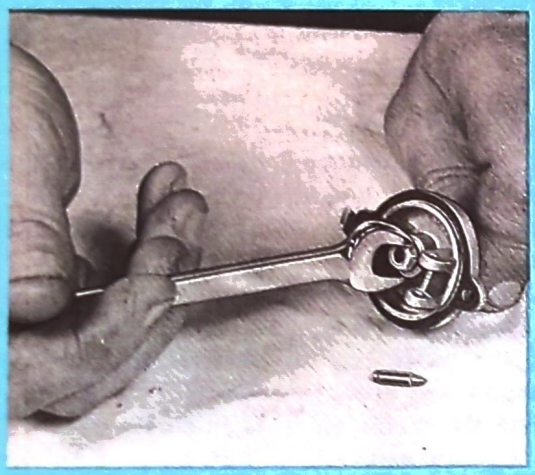
Engine speed is controlled by the throttle butterfly. At low throttle, the butterfly partially blocks the flow of mixture to the cylinder. As speed is increased, the butterfly opens to allow a greater quantity of fuel into the cylinder.

Since outboard engines are variable speed types, a low-speed circuit is required to keep the engine running smoothly at idle and very low speed when the carburetor throttle butterfly is practically closed. This is nothing more than a

DISMANTLING YOUR CARBURETOR

The carburetor cover contains the needle valve assembly. It is controlled by the float via a pair of specially designed levers

To release the carburetor needle valve, remove the pin holding the primary lever. Clean it in kerosene or replace if it is badly coated

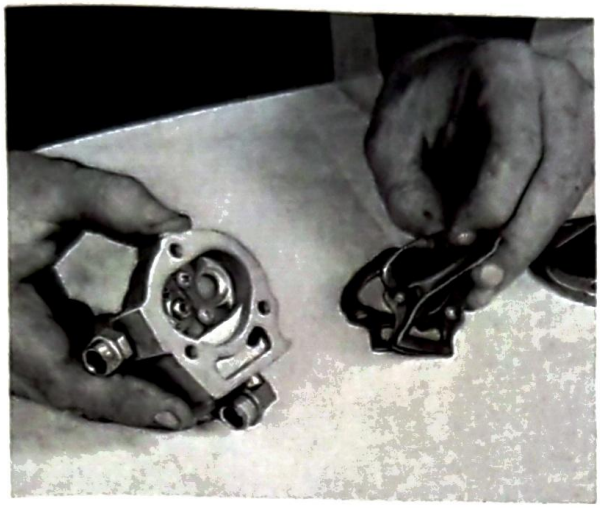


The needle valve seat can be unscrewed after the secondary lever has been removed. If it's coated with varnish, it too must be replaced

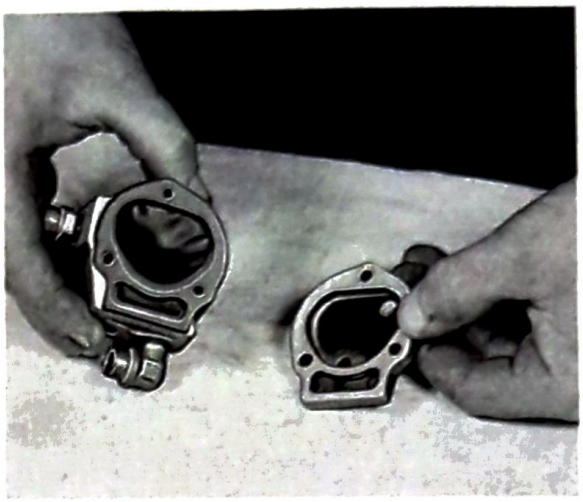
After you have reassembled the valve and seat, you will have to adjust the levers until they are perfectly parallel, bending them as required

Remove the float and check the spring unit found at the top. This unit activates the needle valve and may require adjustment

When the spring is too high or low, the engine can be starved or flooded. Manufacturer's specifications say this one requires 13/32 in.



The fuel-pump diaphragm is held between two gaskets. Once the housing is opened, all must be replaced



A diaphragm and new gaskets can be installed in minutes and will probably cure fuel-pump problems

branch passage from the high-speed flow to a jet on the *cylinder side* of the throttle butterfly. When the throttle butterfly is at idle position, some air flows around it and picks up the fuel being tossed into the air stream by the adjustable low-speed jet.

At high speed the throttle is open, of course, so the piston's suction applies to the entire venturi area of the air tube and the main inlet supplies needed fuel. A relatively insignificant trickle is all that comes from the idle inlet, since air at that point is moving slower than if it all were forced to squeeze past the nearly closed throttle.

There are only three things that can happen should your outboard's fuel system go on strike:

- The engine won't start, or it starts but stalls when any throttle is applied.
- The carburetor floods.
- The engine won't idle properly—stalls or revs too fast.

The most deceiving of the three, of course, is an engine that won't start. The trouble doesn't have to be the fuel system, so here's where your diagnostic powers really get a workout.

You know that if fuel's getting to the cylinders, but the engine won't start, the trouble has to be elsewhere. How do you find out? Give the engine two or three revs to prime it and remove a spark plug. If it's wet and smells of gas, don't blame the carburetor for your troubles unless, of course, it's flooding the engine and the plug's soaking wet. Your problem's probably ignition.

If no fuel's getting through, the trouble could lie anywhere from the fuel tank to the aft end of the carburetor. Experience has shown that most often the trouble is either in the fuel filter or the needle valve in the carburetor bowl, but try the simpler possibilities first.

Check your fuel lines. They might have twisted around and kinked, interrupting the flow of fuel. Mercury engines have a sharp setup that makes this check a snap. Black fuel lines have a white stripe running down the side and white fuel lines have a black stripe. You can easily spot if lines are twisted by checking this stripe.

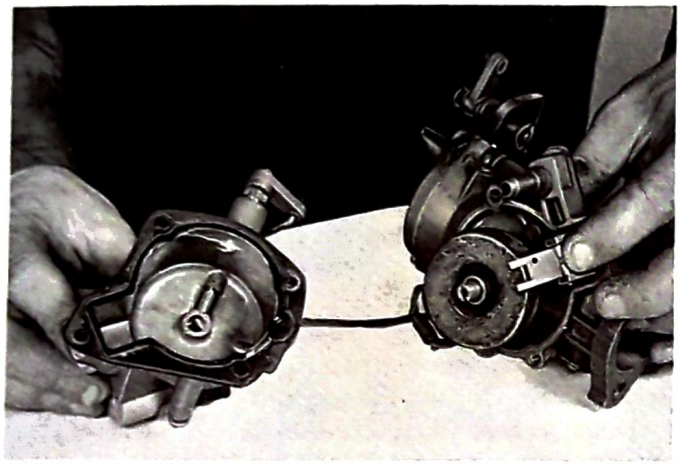
If the lines are okay, test to make sure fuel is getting to the carburetor. Disconnect the line running between the fuel pump and the carburetor, at the carburetor, wrap the end in a rag and pump the primer ball at the fuel tank. If the rag comes away wet, the trouble's in the carburetor —most likely a faulty needle valve.

Chances are, though, the rag will be dry, indicating that fuel's not getting to the carburetor. If so, remove the fuel filter housing and take out the filter. If it's a metal type, as on many Mercury engines, wash it out in kerosene. If it's a ceramic type, as used on many Outboard Marine engines, discard it for a new one.

By the way, although we show removal of the fuel filter with the carburetor off the engine in the illustration, this is only for clarity's sake. All filters can be removed with the carburetor on the engine. The filters of Mercury carburetors are generally located on the carburetor, those of OMC engines are usually located at the carburetor side of the fuel pump.

One other thing could be preventing fuel from reaching the carburetor—a badly shot fuel-pump diaphragm. But it's most unlikely that a dia-

For proper idle, the low-speed adjustment screw should be run in all the way and backed out about ¾ turn



The other popular type of carburetor in current use is disassembled in the way as shown on page 487

troubleshooting carburetors, continued

phragm will suddenly develop a hole big enough to cause this trouble. What usually happens is that the diaphragm develops a pinhole. When this occurs, the engine runs okay at low speed, but stalls out at higher speeds—that pinhole prevents the diaphragm from delivering enough fuel to meet the fuel needs of the engine.

If this seems to be the problem, change the diaphragm. It can usually be done with the pump in the engine. Simply unscrew the housing cover to get at the diaphragm, which is encased between two gaskets. Rip off the old gaskets and diaphragm, and put in new ones.

There's one other long-shot possibility that could be preventing fuel from reaching the cylinders, but it applies only to the carburetor type shown on page 486, which is off an OMC engine. The carburetor gasket between the float chamber and air tube could swell in size, blocking off fuel from the fuel passages. Generally, when this happens you can't get the engine to idle properly, but seldom will swelling completely stop the flow of fuel.

To replace the gasket, the carburetor must be taken apart, removing it from the engine.

Before going on, we ought to mention that you're quite likely to find more than one carburetor on your engine. For instance, two-cylinder Mercs have only one carburetor, but Kiekhaefer's four-cylinder engines use two, as shown here, and their six-cylinder engines use a three-carburetor setup. OMC carburetors are different in design, but contain the same parts and are tackled in the same way.

check when it's flooding

The time to rip into a carburetor is when it's flooding, which usually means that the needle valve is stuck open or the float level adjustment is off. The whole operation is detailed in the photos on page 486. Keep in mind that basic procedure is the same no matter what kind of carburetor you encounter.

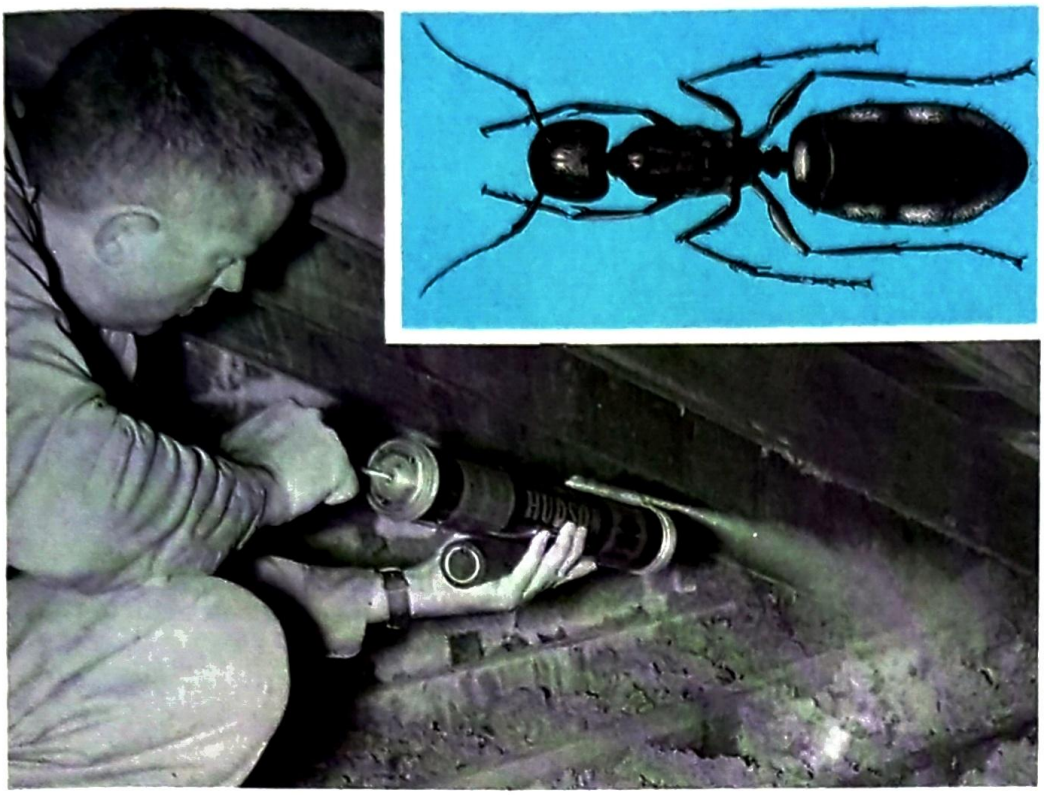
To adjust the float in the carburetor shown above, the unit is first inverted so the float drops down. The edge of the gauge is placed on the housing and the measurement is made to the float. Measurements vary from carburetor to carburetor, but a service manager at an agency dealing in your engine will be happy to give you the correct specification.

how to adjust idle

That leaves us with one other problem to solve—what to do if your engine doesn't idle properly. Try running in the low-speed adjustment screw all the way and then back it off ¾ of a turn. In most cases, this will straighten out the idle. But if it doesn't and you have the type of carburetor pictured being taken apart, remove the adjustment screw, insert the nozzle of an air-pressure hose into the opening and blow dirt from the passage.

If you have the other type of carburetor and it refuses to idle after making the adjustment, don't forget about that carburetor gasket. Replacing it will usually solve the problem.

See also: carburetors, auto; magnetos, outboard; outboard motors, overhauling; outboard motors, repair; outboard motors, storage; outboard motors, used; spark plugs, marine; tools, boat.



Follow a forager home to find the nest. Spray powder gives the best distribution

Rid your house of carpenter ants

BY FRED R. JAMES

Carpenter ants even outclass termites when it comes to doing damage to wooden structures in the United States

IF CARPENTER ANTS are such a menace, why do termites cop all the attention? Largely because when termites decide to add your house to their menu, the damage they do can be downright disastrous. The things that make our six-legged carpenter such a dramatic pest: he operates with far wider freedom and can be more difficult to control.

The hardy carpenter ant thrives under all climatic and topographical conditions. Abundantly located in every state, the carpenter ant is found from sea level to heights of over 9000 ft.. The pest, whose carpentry ability is solely destructive, is strong enough to withstand extremes of temperature. The remarkable queen of the colony has been known to live as long as 15 years, functioning solely as an egg-laying mechanism with a production in the tens of thousands!

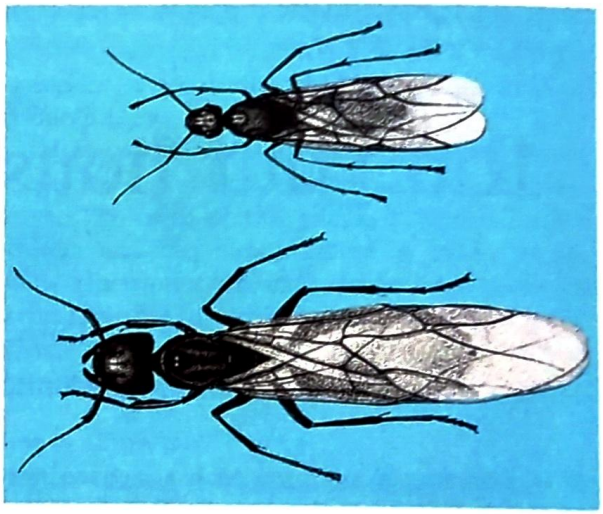
Carpenter ants are the largest of the many species of North American ants ranging in size from about ¼ in. for a minor worker, to ¾ in. for a queen. The color varies from jet black to black and red. Blessed with particularly strong mandibles, they are not above taking a nip out of any human or animal flesh that's near.

The ravenous chewing and indiscriminate chiseling of which this ant is capable has nothing to do with obtaining food. This little chiseler feeds on honeydew and a variety of sweets, along with the fluid from insects that are captured and

carports: see garages; remodeling
car radio: see radios, auto
carriers, car-top: see car-top carriers

Nests within walls can be treated by drilling ¼-in. holes every 16 in. along the baseboard. Pump liquid through the holes with a sprayer

The picture on the left shows an ant colony at work. Below are a winged male (top) and winged female (bottom). The winged ants leave the colony to mate in the spring or summer



Courtesy Connecticut Agricultural Experiment Station

killed. The carpenter ant's excavation is purely by way of gouging out a home from which it can venture forth to seek sweets.

The size of an ant colony may run anywhere from a few members in a newly established nest, to over 3000 individuals in an older nest. Considered by scientists as among the most highly developed insects of the more than 800,000 known species, carpenter ants have a well-ordered social life that's a model of efficiency and team work. Within a single nest, depending on its size, there are one or more queens, some male and female reproductives with well-formed wings, and numerous workers who form the backbone of the interdependent city within wood. They gather the food, feed and care for the queen and her recently hatched offspring, excavate additional chambers, and defend the colony against all enemies.

All types of dwellings of every age can be attacked by the carpenter ant, but he seems to show a preference for structures without basements or with partial basements, buildings with low foundations, rambling porches, and structures with loose construction, such as cabins.

The whole trick in eliminating an infestation of carpenter ants is finding the nest. Too often stray workers will be seen walking about the house in an aimless fashion, far removed from a hidden nest of numerous brothers and sisters. For every stray killed outside the colony it seems that five replace the pest—coming, of course, from the elusive nest. But once this nest is pinpointed it is easy to apply any one of several effective pesticides to get long-lasting relief.

An important thing to remember in warring on the wood-chiseling ants is that they consistently show a preference for moisture. Soft, damp, de-

cayed areas of roofs, shingles, sheathing, clapboard siding, columns, posts, pillars, window sills and frames, and other structural offsets that have been visited by dampness are typical sites of a nest. The actual rate of damage to the wood is dependent on living space required by a rapidly expanding colony. It is interesting to point out that if there is subsequent insufficient moisture, or too much water seepage, the colony will seek a new home.

What are the signs of a typical infestation? As mentioned, the homeowner becomes conscious of a persistent stream of foraging worker ants whose numbers never seem to diminish despite constant applications of insecticides.

In cases of a very heavy ant population on the premises, it is possible to hear carpenter ants with an unaided ear. A faint, rustling sound, believed to be a form of actual communication rather than audible eating noises, may occur.

The expelled borings that accumulate as wood shavings below slit-like openings in wood are a tell-tale sign.

watch around windows

On a warm day in spring or summer winged males and females may emerge from nowhere unexpectedly. These romantic individuals go on a mating flight, but first seek to escape out the nearest window. Incidentally, when these flyers emerge it is usually evidence that a colony is at least three years old and may contain upwards of 2000 residents.

Inasmuch as moisture plays such a vital role in attracting carpenter ant nests, it is wise to check all spots that in any way might contribute dampness. These include:

- Sweaty plumbing.
- Damaged flashing.
- Plugged drains and gutters.
- Poorly fitted or damaged sidings, wooden shingle roofs, and areas between the roof and ceiling of flat deck porches.
- Leaking door and window frames.
- Wood in direct contact with soil such as porch supports, siding, stair risers.
- Wood in areas with faulty ventilation such as cellars, crawl spaces, attics.
- Wood scraps in dirt-filled slab porches.
- Areas where condensation directly affects wood.

Openings to the outside of buildings that might serve as avenues of direct entry for carpenter ants should be calked and sealed as a matter of prevention. Keep tree limbs which hang near the house trimmed back. Inspect all climbing vines carefully.

Trees are the natural habitat of carpenter ants and if they can be stopped here before they gain entry to the home the control job is an easier one. Holes or "windows" in trees usually lead to a nest. These are most often found in knot holes, scars, dead sections, and crotch angles. These should be plugged with tree compound or cement.

Many cases of carpenter ant infestation in a home originate from infested firewood unwittingly carried indoors. Always make an extra check of this material, and, as an added precaution, spray the cords with insecticide.

A new device that shows promise in detecting hidden carpenter ant nests is a lightweight, portable, electronic detector. A probing needle is applied to surfaces that are suspect and the sounds of movement and "talk" can be heard.

zero in with flushing agents

Another method of "zeroing in" on a hidden nest is through the use of insect powders and aerosol insecticides as flushing agents. If you trace the route of travel of the ants back to a point of origin in the wood of your house, you can shoot aerosol mists of pyrethrins or dusts containing 5 or 6 percent DDT or chlordane powder into all cracks and crevices in the vicinity. Where roaming ants can't be traced to a point of origin, apply pesticides to suspicious damp areas. Often, only a slight application of these chemicals will cause ants to tumble out to reveal the nest which you can then treat more thoroughly.

Chlordane is probably considered the best all-around insecticide in control of ants. The material should be liberally applied to the nest and areas immediately surrounding it. Use a compressed air sprayer to get saturation. Aerosols and mists do not leave enough residual chemical. Be absolutely certain to read and follow label instructions. Recommended mixtures are 2 percent or 3 percent oil solutions or water emulsions.

Always apply insecticides so they'll reach the maximum amount of the areas traveled by the insects. Unless there are ample existing cracks and crevices in the immediate area of a nest, it is often advisable to drill ¼- to ⅜-in. holes at 12-in. intervals in infested timbers to apply chemicals for the purpose of intercepting galleries.

See also: insect control; landscaping; lawns; termites.

Chassis for a Suburba-car

The Suburba-car chassis was designed under the auspices of POPULAR MECHANICS by the students at the Illinois Institute of Technology. It was designed to be the "missing link in transportation,"—a truly compact car that one or two people might use for suburban shopping or commuting. Readers were asked to submit body designs to fit the chassis, and the design of Norman K. Niemi was judged as the best of the large number submitted. His design is really a triple design—the three drawings at the top of the facing page—demonstrating the versatility of the chassis. It could be a practical little pick-up for light hauling, a nifty little runabout for quick shopping trips, or the smartest, tiniest station wagon ever seen. Try building the chassis yourself, then designing your own body for it.

BUILDING THE CHASSIS frame is a pure and simple welding job, only a few of the parts being a little tricky to fit and hold in place while you're pouring rod. In some instances dimensions of parts give only the rough sizes and angles as some filing and hand fitting is essential to get things square with the world before welding. Also, there's some latitude for exercise of your own ingenuity in making and assembling some of the parts. An example is the steering-gear assembly. The original is detailed, and testing has proved it to be serviceable and entirely safe for average use, but, of course, it can be bushed and otherwise elaborated if desired. Also, the inclination of the steering column and placement of the tilting seats have been purposely left to the desires of the individual builder.

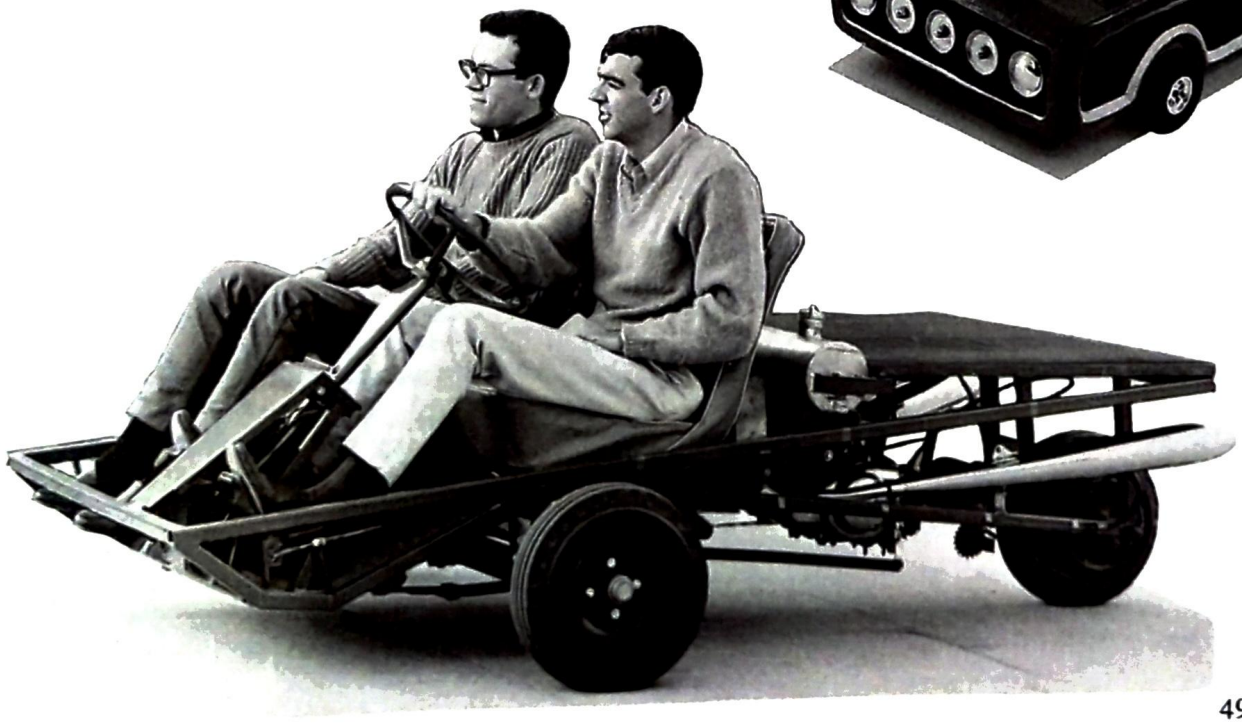
Before welding the four members of the basic frame make sure that the assembly is square at the corners and true along the length. Keep in mind that in the assembly the rectangular frame is supported at an angle with the horizontal, its inclination being forward, but that the "bridge" supporting the rear deck rides level. Elevation of the deck framing is determined by the fit and slant of the four supporting members, or legs, as in the exploded view. Once the basic rectangular frame has been assembled and the additional parts No. 30, 31, 32 and 33 have been welded in place, take special note of the placement of the remaining cross members from No. 34 forward, also parts No. 12, which form the foot "well" when all cross members are in place. The full-length members are not dimensioned, as they must be cut, fitted and welded in place individually. Not shown is the fourth member from the front; it's directly over the front axle and is carried on two projections, or legs, made by welding two 2-in. lengths of tubing to parts No. 30. It's important when fitting and installing these members to see that they are at right angles to the lengthwise members and to make sure that all welds are sound, as rigidity and stability of the frame is largely dependent on these members.

Comes then the assembly and installation of the front axle which is almost entirely unitized

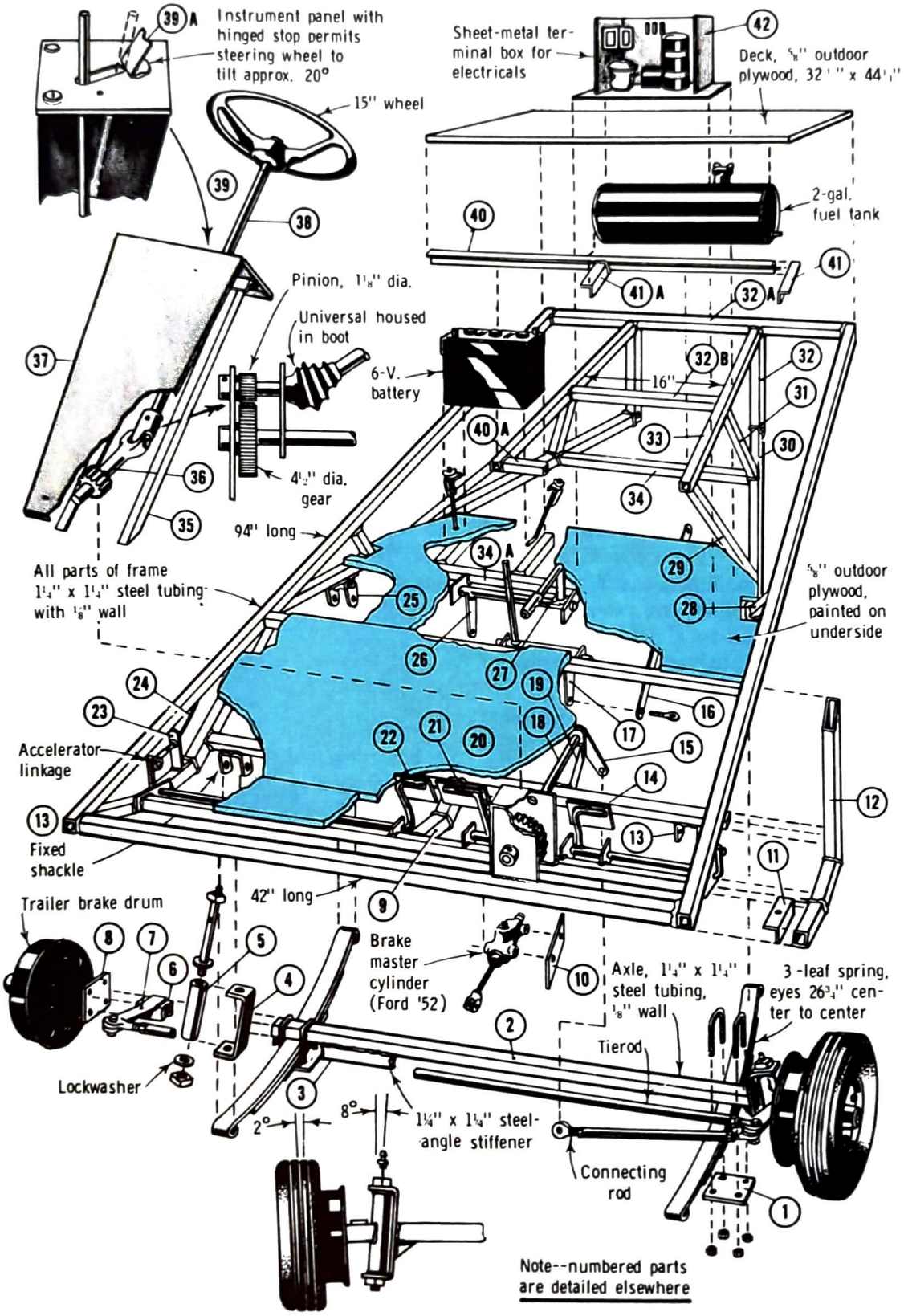
from stock materials and parts and is sprung to the frame with two under-slung 3-leaf springs. The fixed spring shackles, parts No. 13, are of the same thickness of material as the free shackles, but note they are a single piece and bent to a U-shape. The free shackles should have grease fittings installed.

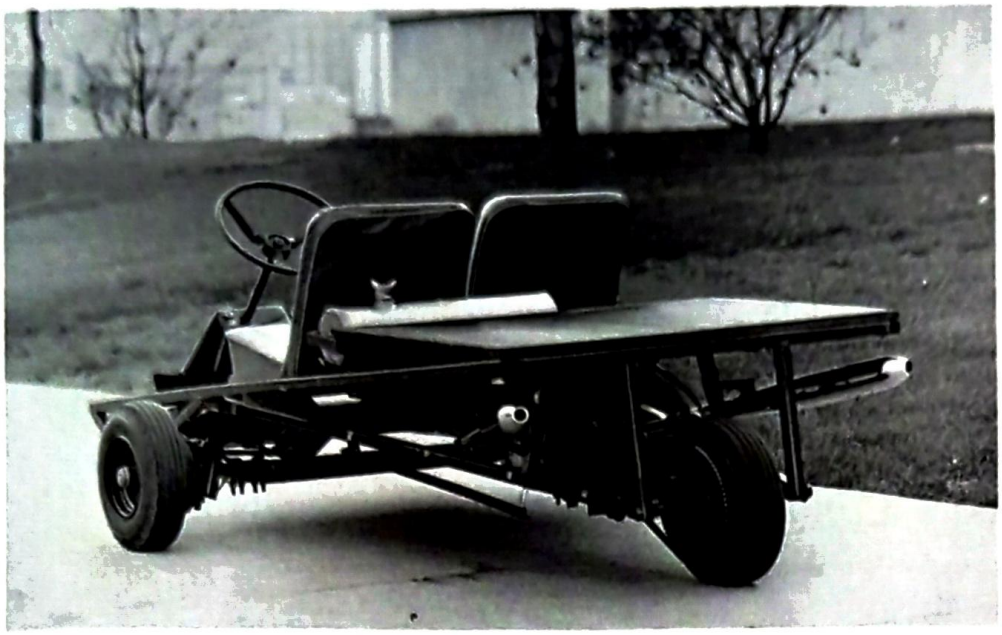
The axle proper is a length of 1¼-in. square steel tubing with the added rigidity of a steel angle welded to the lower face along the full length between the spring mounts. The kingpin yokes are stiffened with triangular braces welded to the yokes and axle. The kingpins are ¾-in. bolts, each being counterbored and tapped for a grease fitting, the counterbore extending longitudinally about 1½ in. to a hole drilled transversely at right angles to provide for passage of lubricant.

To get the assembly up on its wheels you next make and assemble the rear axle. Here the brake drum serves both for braking the car and as a mounting for the driven sprocket, the latter be-



chassis for a Suburba-car, continued



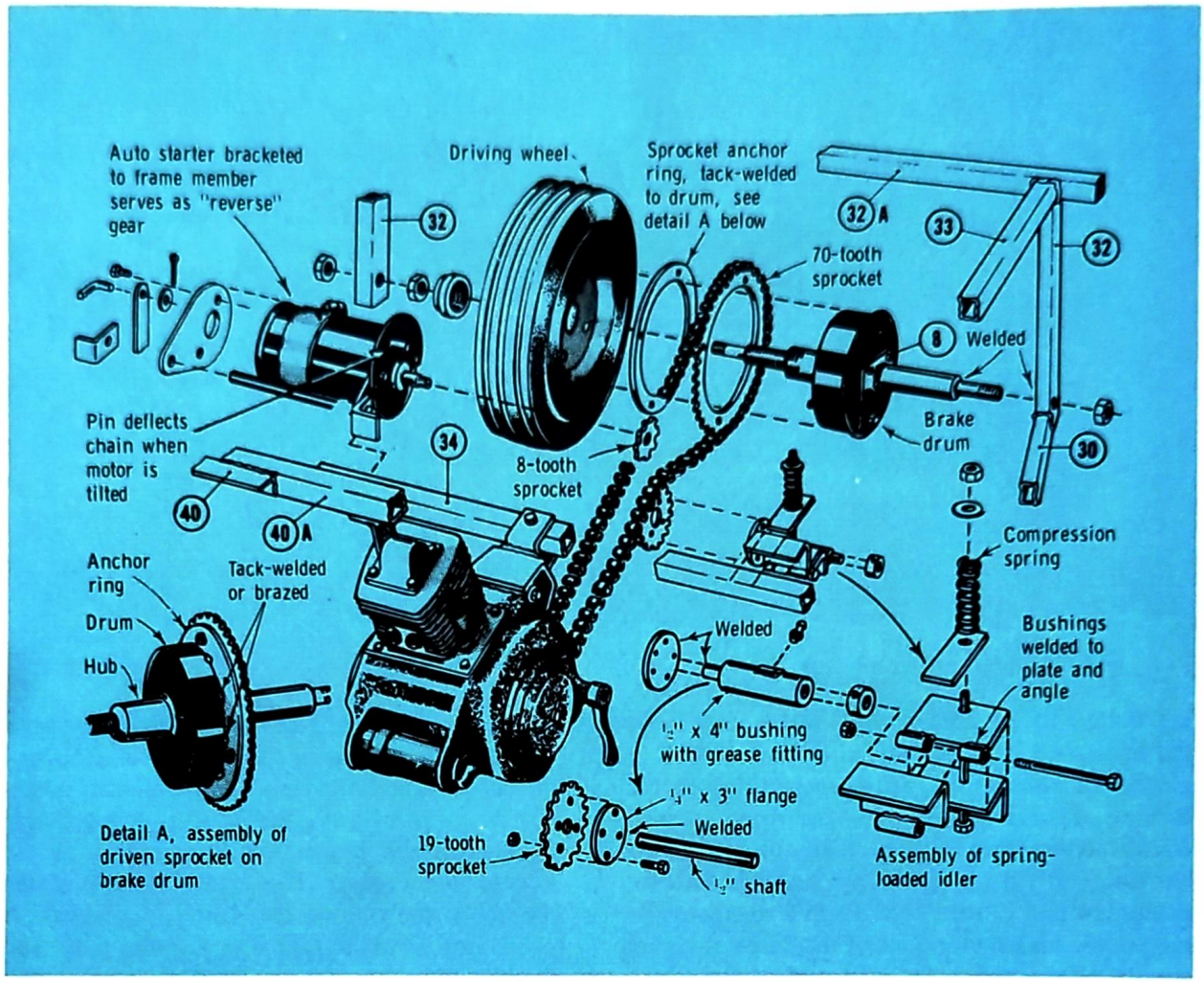


ing bolted to an anchor ring which slips onto the drum and is either brazed or tack-welded in place. An alternative to the anchor ring is the brazing of four bolt lugs to the drum, spaced equidistantly. Care must be taken to assure that the ring (or lugs) is not only concentric with the drum, but that it turns true. Even a slight wobble may cause undue vibration of the chain at higher speeds. When assembled, the end of the sleeve carrying the plate bolted to the brake drum is welded to upright No. 32. The weld takes the torque, or axle wrap, when the brake is applied.

The engine, a Honda Twin Series 150, is bracketed to frame members No. 34 and 40A and care must be taken to assure that the supporting brackets are in the proper position so that the sprockets line up when the engine is installed. The drive chain is standard cycle chain, the slack being carried on a sprocket idler mounted on a pivoted, spring-loaded bracket. The engine is, of course, equipped with its own starter, generator and transmission built in, but the latter is not provided with reversing gear. To back the car, an auto starter fitted with an 8-tooth sprocket to engage the drive chain is pivoted to the frame just ahead of the drive wheel and is actuated and energized by means of the lever and linkage No. 26 and 27. To back the car, the driver lifts the L-shaped lever, No. 27, which raises the starter by means of the linkage, No. 26. The sprocket on the starter shaft engages the drive chain and, simultaneously, the driver presses the pushbutton switch in the end of the lever, thus energizing the starter. As the starter is raised the pin on the half-circular disk (bolted to the shaft end) deflects the drive chain downward at a point just ahead of the sprocket, thus preventing the latter from disengaging as the starter is energized. The exploded view of the assembly shows how the starter is pivoted. A ¼-in. rod, threaded at the forward end and fitted with an adjustable yoke, permits correct positioning of the starter. The starter shaft is shortened to about 1-in. projection and is either shouldered and threaded, or the sprocket attached by means of a hub and key or setscrew.

The brake master cylinder is actuated by the center pedal; the left pedal controls the clutch and the right is the accelerator, or gas pedal. Both the latter are similar in construction and assembly, as will be noted in the details. Both actuate the clutch and fuel feed through flexible cable controls, part No. 24, leading from the control arms back along the frame to the clutch and carburetor. The control cables should be attached with wrappings of adhesive tape, or better, by means of U-shaped metal clips fastened with screws turned into tapped holes in the frame members.

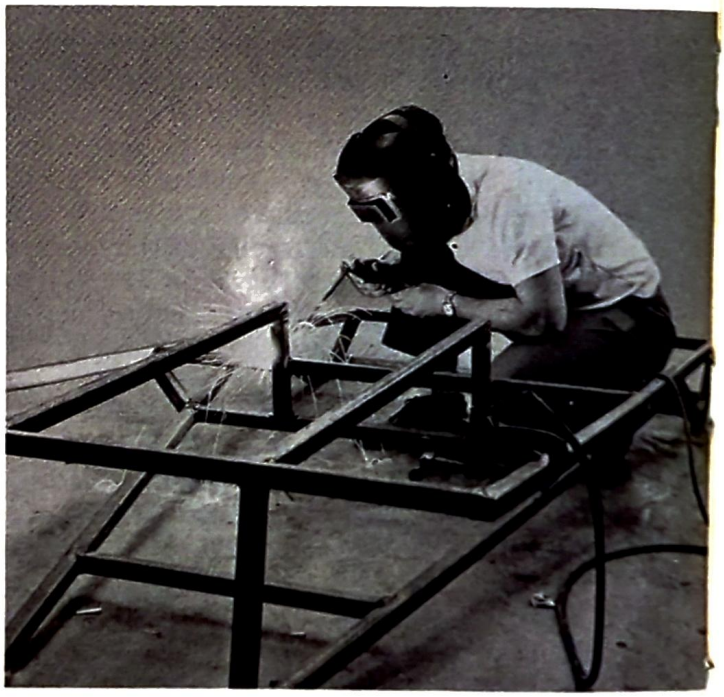
The gearshift lever is directly in front of the reverse lever, both being located midway between the seats. The shift linkage consists of the parts No. 16 and 17, the former connected to the shifter arm on the engine. The steering-gear housing is located between the brake and clutch pedals and is shown both in cutaway and ex-

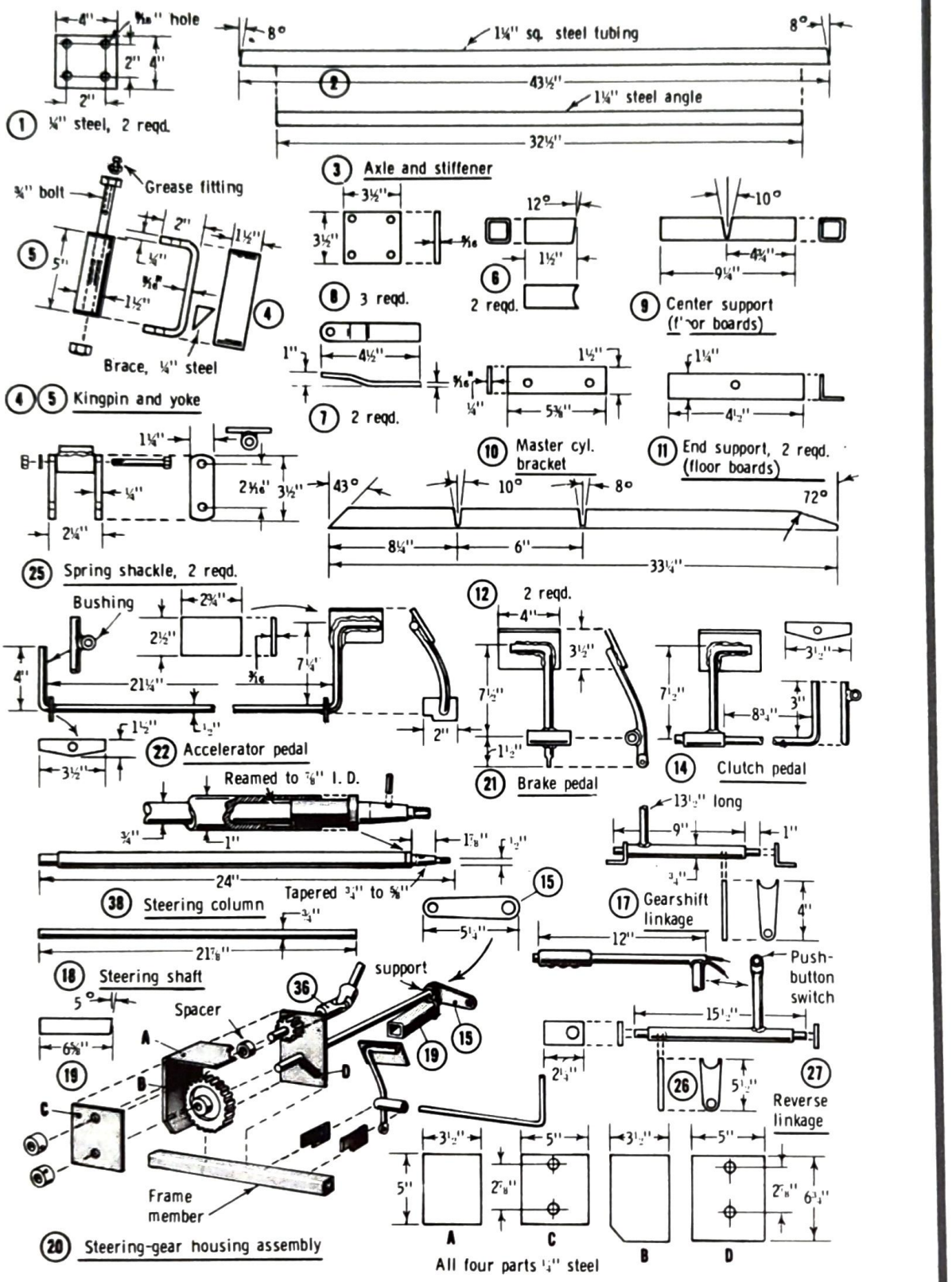


chassis for a Suburba-car, continued

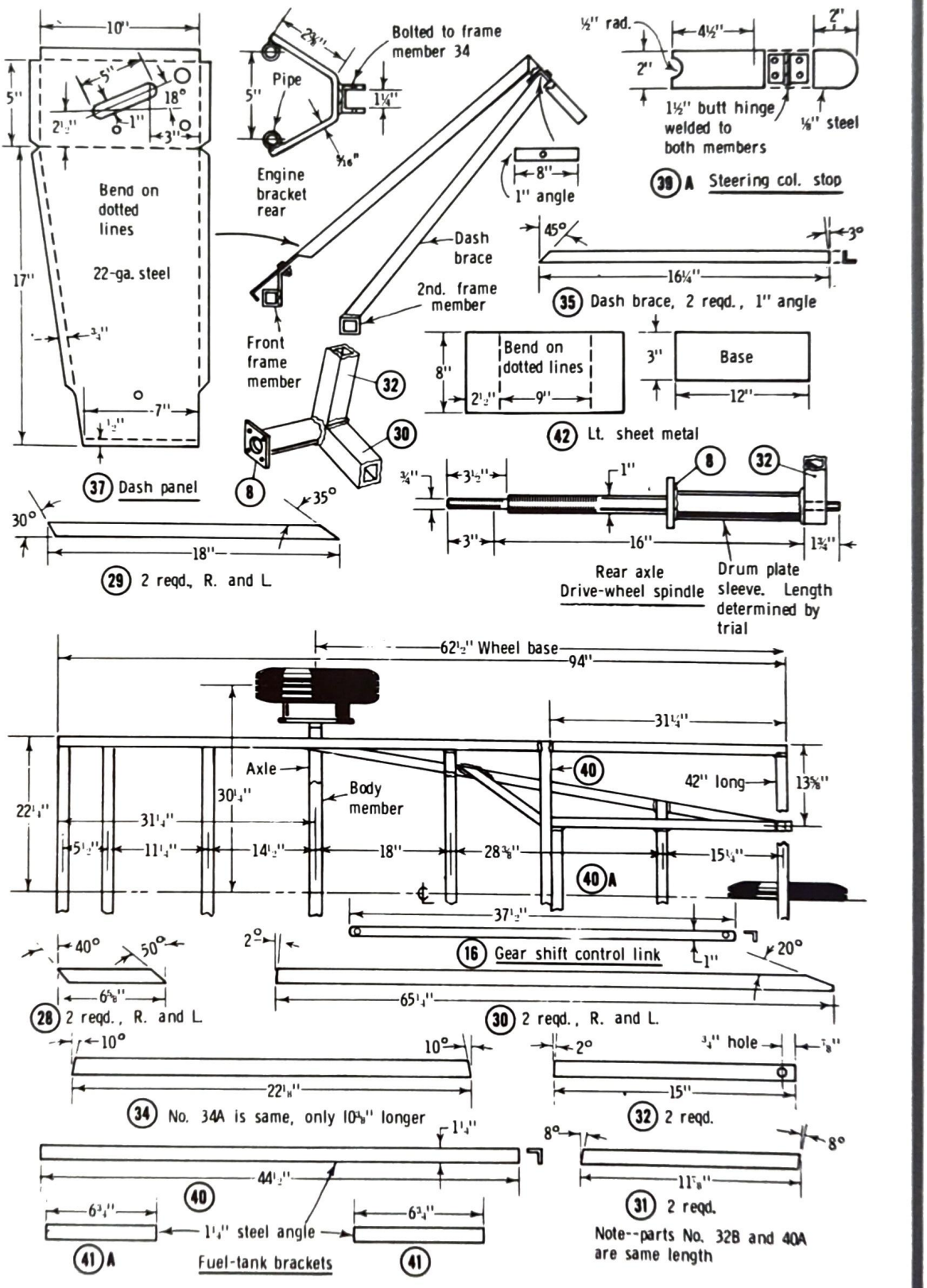
ploded views, the housing being welded to the second cross member of the frame. It's a relatively simple assembly but, of course, care must be taken to assure correct alignment of the pinion and gear and the shafting. The steering column passes through an angled slot in the instrument panel stop, part No. 39A. Lifting the stop permits the column and wheel to tilt approximately 20°, thus giving easy access to the driver's seat. Installation of the seats, fuel tank, floorboards, battery, rear deck and finally the electricals (according to the Honda manual) completes the chassis.

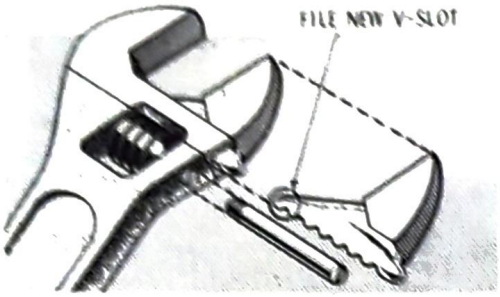
By careful scrounging in an automotive graveyard, you can come up with the parts specified, or adaptable substitutes. The prototype was built with the steering wheel from an old car, the fuel tank from a racing kart, and the bucket seats from a foreign car. All three wheels, including tires (4.80 by 16), brake drums, and leaf springs, were taken from a Gator boat trailer.



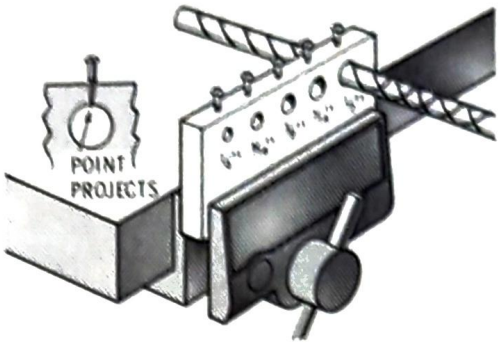

1 ¼" steel, 2 reqd.
2
1¼" sq. steel tubing
43½"
1¼" steel angle
32½"
3 Axle and stiffener
8 3 reqd.
6 2 reqd.
9 Center support (floor boards)
5
Grease fitting
¾" bolt
Brace, ¼" steel
4 5 Kingpin and yoke
7 2 reqd.
10 Master cyl. bracket
11 End support, 2 reqd. (floor boards)
25 Spring shackle, 2 reqd.
Bushing
22 Accelerator pedal
12 2 reqd.
21 Brake pedal
14 Clutch pedal
Reamed to ⅞" I. D.
38 Steering column
Tapered ¾" to ⅝"
15
17 Gearshift linkage
13½" long
Push-button switch
18 Steering shaft
Spacer
support
36
19
26
27 Reverse linkage
Frame member
20 Steering-gear housing assembly
A
B
C
D
All four parts ¼" steel

chassis for a Suburba-car, continued

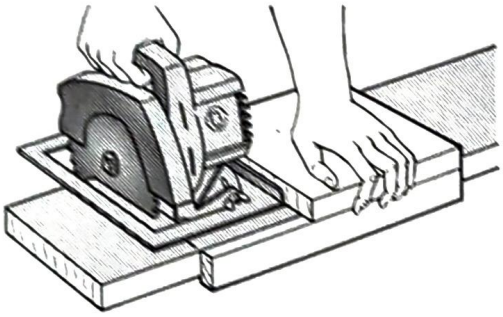




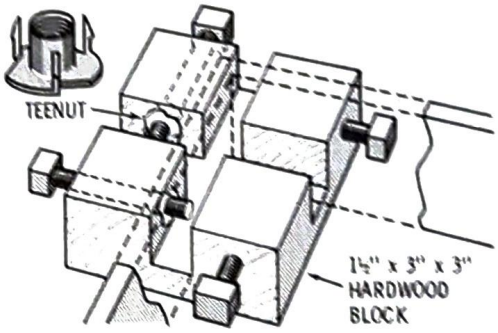
You can extend the reach of your adjustable wrench by removing the screw and filing an extra V-slot in the bottom edge.



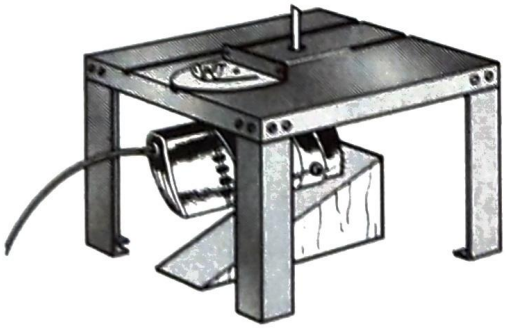
To build a jig for scoring dowels to be glued, drill a series of holes in a hardwood block. Drive No. 6 x ¾-in. roundhead wood screws through the edge so they project enough to score 1/16 in. deep. Twist the dowels through twice.



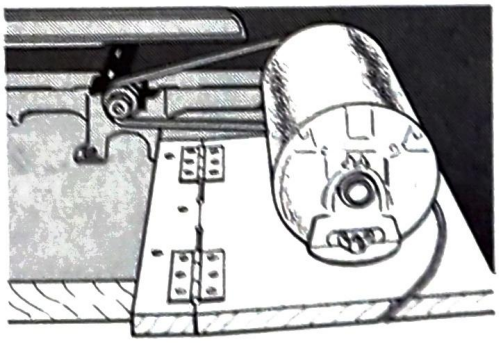
This squaring guide built from scrap lumber lets you crosscut squarely to a layout mark, without having to guide the saw along a line.



A corner clamp will hold small stock firmly while you glue and brad box joints. Just cut ¾ x 1-in. slots on the centerlines of a hardwood block. Use Tee-nuts and bolts as clamps.



Wedging a tapered block under a saber saw clamped to a table will eliminate most vibration and make for more accurate cutting.

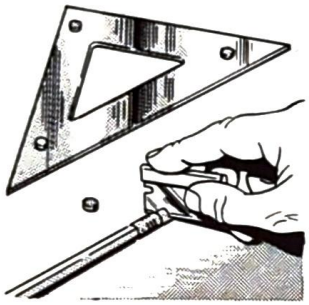


One motor can move around in your shop if you mount it on a board with half a pair of loose-pin hinges screwed to the edge. The other half of the hinge is mounted on the tool bench. The pivoting weight puts tension on the belt.

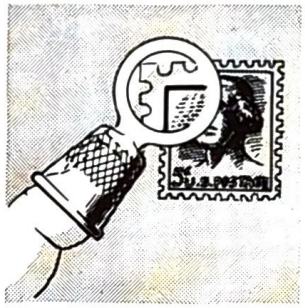
Use an old hacksaw blade to make a straight edge for tearing masking tape. Notch the ends, and then mount it on the tape roll with a rubber band through a soda straw.

When drilling a hole for a bolt, use an adjustable end wrench as a simple substitute for calipers.

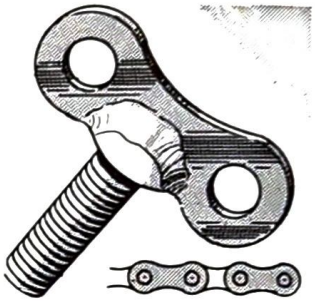
When you are fishing, tape pieces of styrofoam to the frames of your glasses. This will keep them afloat if they should accidentally fall overboard.



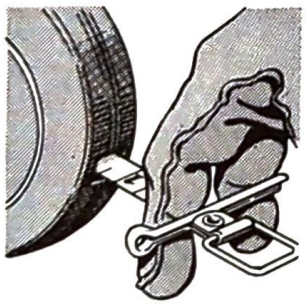
Skidproof feet for an artist's triangle can be made by cutting small pieces of pencil eraser and gluing them to the triangle.



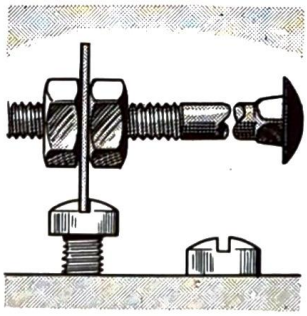
This handy fingertip magnifying glass is perfect for hobbyists. File a slot in the end of a thimble and glue a small magnifying glass in the slot.



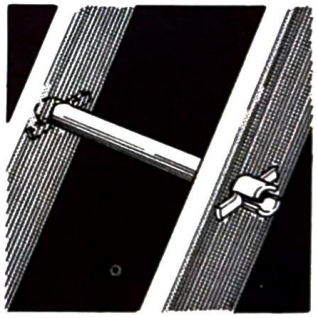
Any machine screw can be tightened with the fingers if you solder a link from a bicycle chain in the slot to serve as a wing head.



Slip a cotter pin over the end of your measuring tape to serve as a bar grip. This is especially useful in cold weather.



If you don't have an offset screwdriver handy you can improvise one by fastening a washer to a long bolt with two nuts.



Replace that broken ladder rung with a length of ¾-in. pipe. Allow it to project on both sides, then cut and bend the ends to form flanges.

Put your small fry in the driver's seat of this great little buggy and watch him grin

Build your kids the sidewalk classic

Designed by ROBERT WOOLSON

WITH ITS BLACK FABRIC TOP, leather dashboard straps and gas headlamps, this bright red replica of its prototype—the open roadster of the early years of this century—will bring a twinge of nostalgia to grownups and a shriek of delight from the younger set.

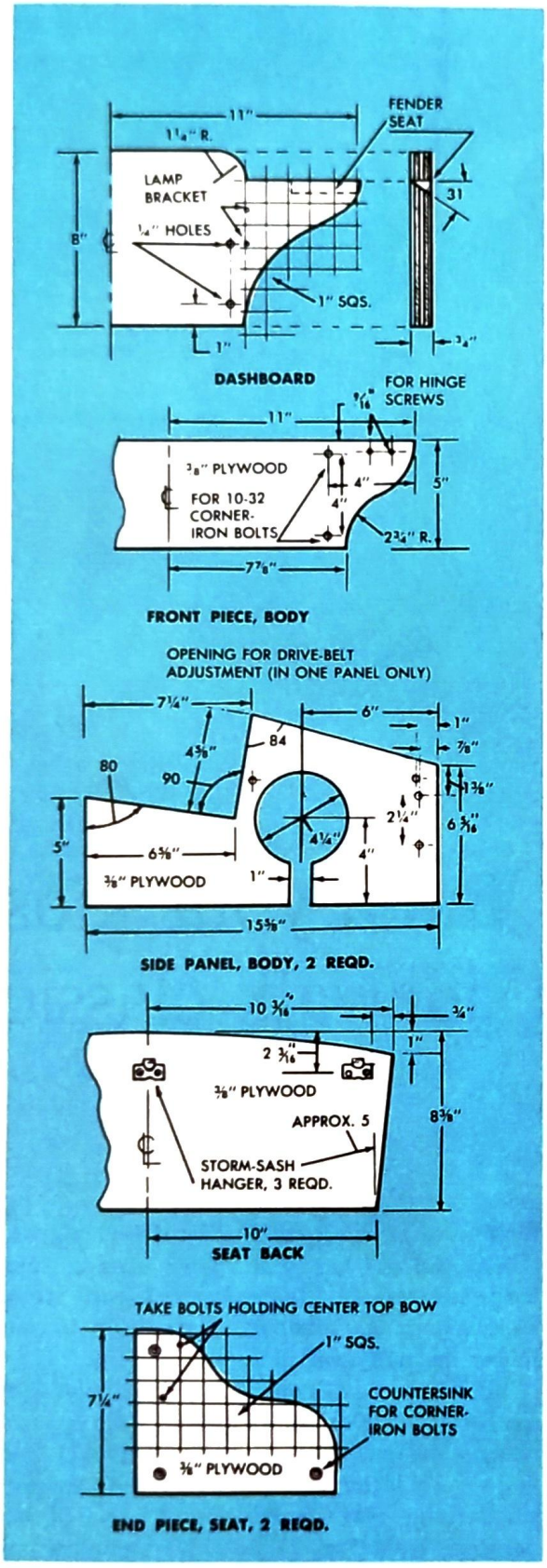
It does a safe, quiet 5 miles per hour, has a 12-volt electrical system driving a 6-volt automobile generator which serves as the motor, and carries its own built-in battery charger.

It's great for everyday fun on the sidewalk and sensational in the local Fourth of July parade.

You can buy nearly all of the parts at your hardware store or at an automotive-parts store. Assembly is not difficult, particularly if you follow the pull-apart drawings carefully.

Before you buy or cut any materials, run over the list of keyed parts and carefully check each one on the pull-apart drawings. This will give you a good idea of what goes where on the plywood frame. The dimensions of some of the parts you have to make, bolt sizes and other im-

build the sidewalk classic, continued

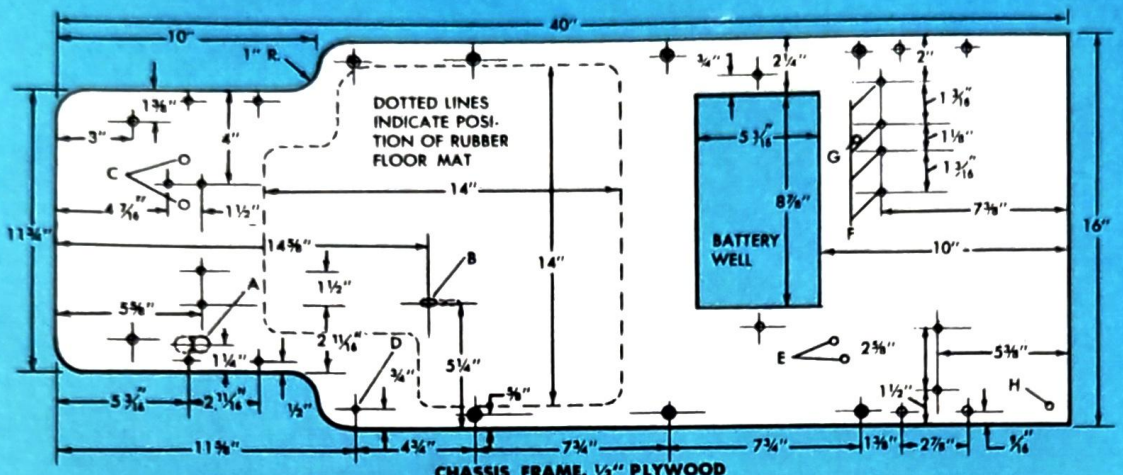


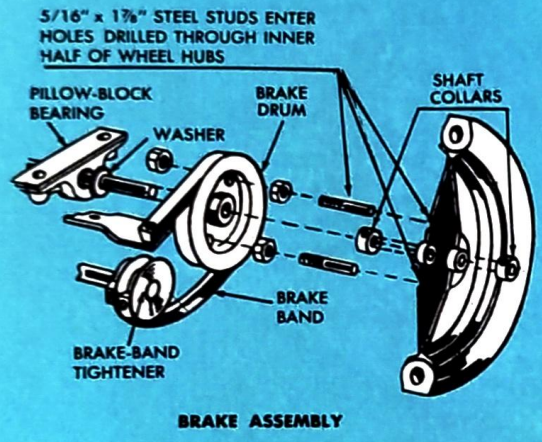
The steering column is held in position by a plywood support and metal brace to the frame. A metal angle serves as the top bearing

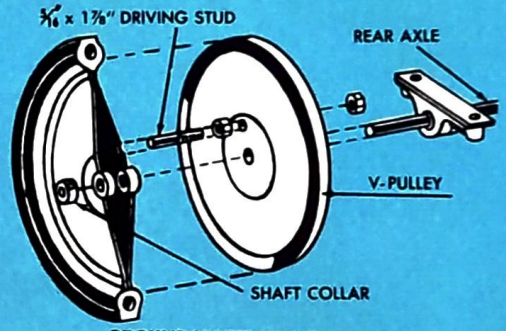
portant information are in the keyed list along with parts nomenclature.

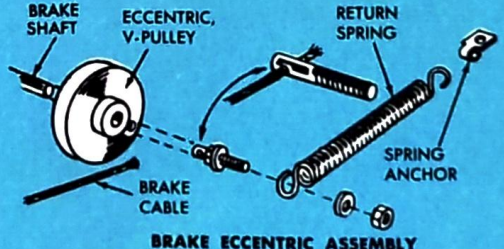
Begin construction with the frame which is cut from a piece of ½-in. plywood. Cut the piece slightly oversize, about ⅛ in. all around, to allow for finishing the edges; there must be no splinters. Then lay out the hole pattern and drill all the holes which are located by dimension, except the holes F. Hole diameters are taken directly from the bolt sizes given in the parts list. The seven countersunk holes (indicated by concentric circles) are drilled and countersunk for 1½-in. No. 8 F.H. wood screws. These hold the brake-shaft supports and the front-fender support, parts No. 27 and 31. One hole, D, is not countersunk, as it takes the screw holding the lower end of the steering-column brace, part No. 59, which passes through the frame and turns into the front-fender support.

Holes A and B in the frame must be drilled at an angle, hole A for the steering post and B for the brake cable. Drill hole A slightly undersize and at the approximate angle and then work it to size and the correct angle later on with a round



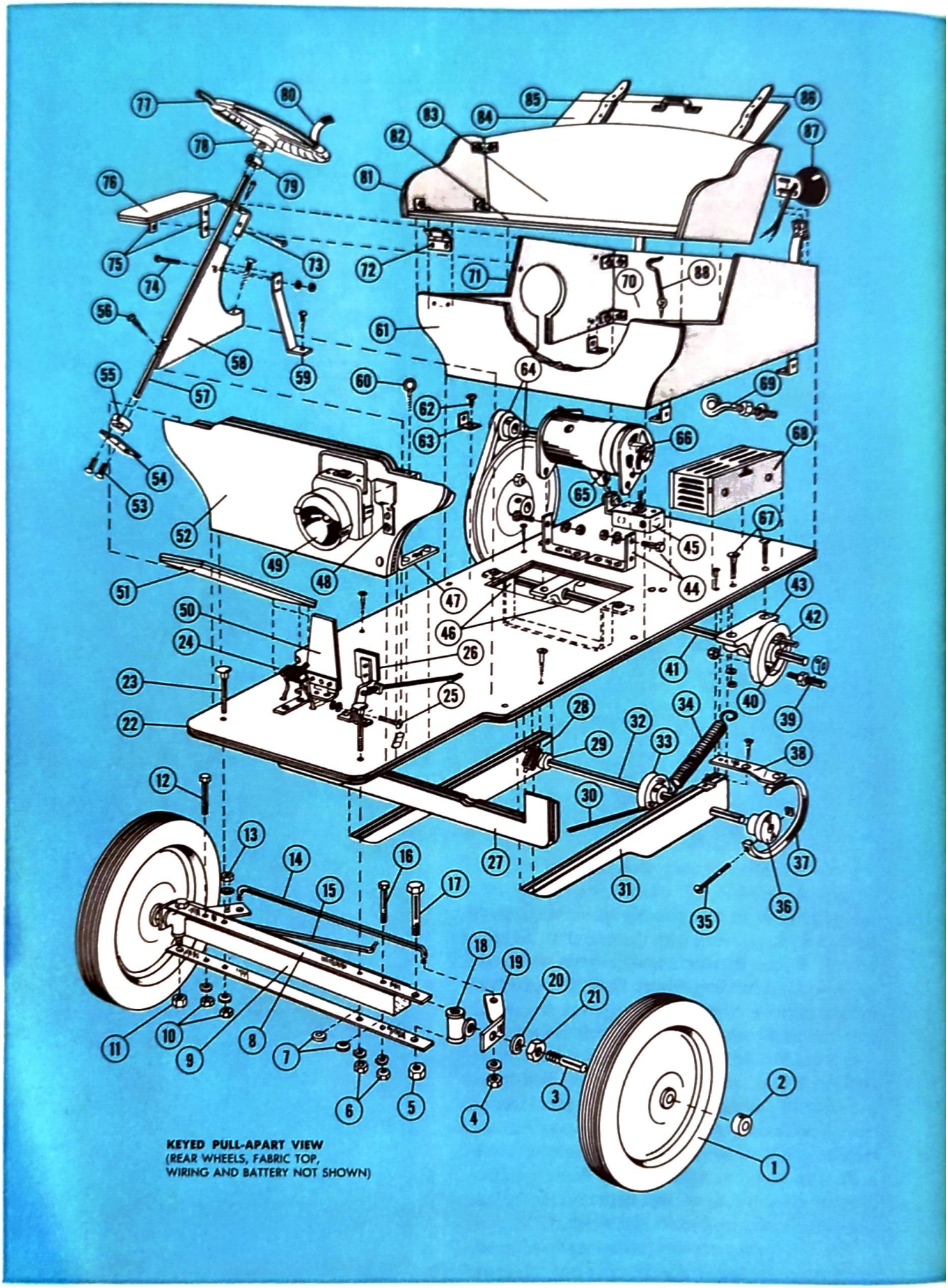






file when you fit the steering post. Also you'll have to do some work with the round file to bring hole B to the correct angle to take the brake cable without binding. Holes C, E, G and H are for the passage of wiring through the frame and only the approximate location is indicated. The four holes F take 10-24 F.H. screws (with nuts) and hold two 3-in. corner irons which serve as motor-mounting brackets. It's a good idea to have your motor on hand so that you can determine the distance between the pairs of holes, as it may vary from that given. Be sure of the over-all dimensions of the battery case before you cut the well and make the support.

The front axle consists of a length of hardwood and two steel straps. Note in the pull-apart



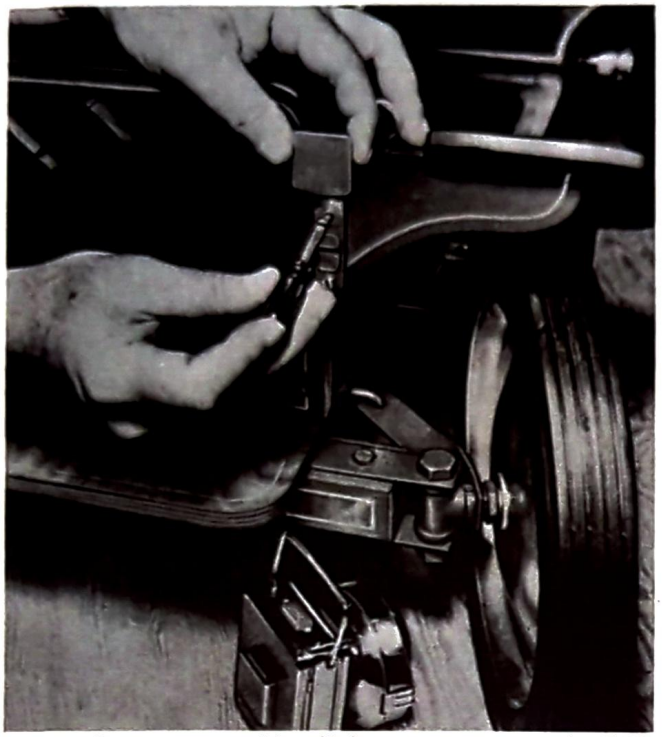
KEYED PULL-APART VIEW
(REAR WHEELS, FABRIC TOP,
WIRING AND BATTERY NOT SHOWN)

KEYED LEGENDS

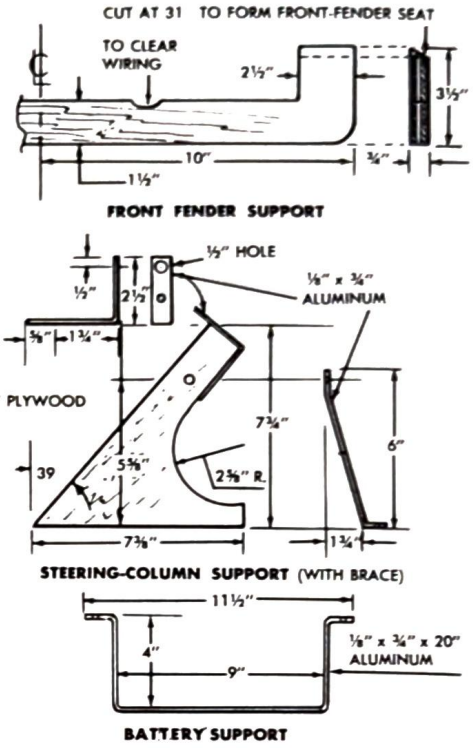
1. WHEEL, SEMI-PNEUMATIC, 12 x 1.75. BALL-BEARING. FOUR REQUIRED (SPARE WHEEL OPTIONAL)
2. SHAFT COLLAR, ½ IN.
3. WHEEL SPINDLE, ½ x APPROX. 3 IN. STEEL. TH'D. ½–13. TWO REQUIRED
4. HEX NUT, ½ IN., WITH WASHER
5. HEX NUT, ½ IN., TWO REQUIRED
6. HEX NUTS AND LOCK WASHERS, ¼ IN.
7. FLAT SPACER WASHERS, ONLY TWO SHOWN; FOUR REQUIRED
8. AXLE STRAPS, TWO REQUIRED
9. AXLE, HARDWOOD
10. SAME AS PART NO. 6
11. SAME AS PART NO. 5
12. HEX-HEAD MACHINE BOLT, ¼ x 2¼ IN.
13. HEX NUT AND WASHER, ¼ IN., TURNS ONTO END OF STEERING ROD
14. TIE ROD
15. STEERING ROD
16. SAME AS PART NO. 12. NOTE THAT BOLTS NO. 12 AND 16 PASS THROUGH AXLE ONLY, NOT THROUGH FRAME
17. KINGBOLT, ½ x 2½ IN., TWO REQUIRED
18. PIPE TEE, ¼-IN. TWO REQUIRED. THREADS REAMED OUT TO TAKE ½-IN. KINGBOLT
19. STEERING ARM, TWO REQUIRED, R. AND L., ONE HAS THIRD HOLE FOR STEERING ROD
20. LOCK WASHER, ½ IN.
21. HEX NUT, ½ IN.
22. CHASSIS FRAME, ½-IN. PLYWOOD
23. CARRIAGE BOLT, ¼ x 3 IN. TWO REQUIRED
24. FOOT SWITCH, DPST, PUSH-BUTTON TYPE, NORMALLY OFF
25. ROUND-HEAD 10-24 SCREW, ¾ IN. LONG. REQUIRES TWO NUTS, LOCK WASHER BETWEEN NUTS AND TWO SPACER WASHERS
26. BRAKE PEDAL
27. FRONT-FENDER SUPPORT
28. SPOTLIGHT SWITCH, LEVER-ACTUATED, SPDT, BUT USED AS SPST ONLY
29. SHAFT COLLAR, ½-IN., ACTUATES SPOTLIGHT SWITCH. A SECOND COLLAR IS REQUIRED ON BRAKE SHAFT TO HOLD IT IN POSITION AFTER ASSEMBLY
30. WIRE BRAKE CABLE ⅛-IN. DIAMETER, OVERALL LENGTH APPROX. 28½"
31. BRAKE-SHAFT SUPPORT, OR BEARING. TWO REQUIRED
32. BRAKE SHAFT, ½ x 17-IN. STEEL SHAFTING
33. BRAKE ECCENTRIC, 3-IN.-DIA. V-PULLEY
34. BRAKE RETURN SPRING, 6¾ IN. LONG, 1-IN.-DIA. COILS
35. ROUND-HEAD 10-24 SCREW, 2 IN. LONG. LOCKS END OF BRAKE BAND
36. BRAKE-BAND TIGHTENER, 2-IN. V-PULLEY
37. BRAKE BAND, ½-IN. V-BELT, OVERALL LENGTH APPROX. 16½"
38. BRAKE-BAND LUG, ⅛ x 1 x 6-IN. STEEL. OUTER END GIVEN ONE-QUARTER TWIST
39. SHAFT COLLAR, ½-IN.
40. BRAKE STUD, 5/16-IN. STEEL, TWO REQUIRED. THREAD 5/16-18 AND FIT EACH WITH TWO HEX NUTS
*41. REAR AXLE, ½ x 23¼-IN. LENGTH OF DRILL ROD
42. BRAKE DRUM, 4-IN. V-PULLEY. DRILL 5/16-IN. HOLES THROUGH WEB ON 2⅛-IN. CENTERS FOR BRAKE STUDS
43. BALL-BEARING PILLOW BLOCK FOR ½-IN. SHAFT. TWO REQUIRED
44. MACHINE BOLT, ¼ x 1 IN. WITH NUT AND LOCK WASHER. TWO REQUIRED. THESE BOLTS JOIN MOTOR MOUNTING LUGS TO 3-IN. CORNER IRONS, ONE LEG OF EACH IRON BEING CUT TO 2⅛ IN. LENGTH. DRILL HOLES FOR BOLTS CENTERING 1⅝ IN. ABOVE THE CORNER-IRON BEND
45. DPDT TOGGLE SWITCH. SEE WIRING DIAGRAM
46. BATTERY WELL AND SUPPORT
**47. CORNER IRON, TWO REQUIRED TO SUPPORT DASHBOARD
48. HEAD LAMP BRACKET
49. HEAD LAMP, DRY-CELL POWERED, TWO REQUIRED
50. PEDAL. ACTUATES START-STOP SWITCH
51. FRONT FENDER, TWO REQUIRED. EACH CUT FROM ⅜-IN. PLYWOOD, 4 IN. WIDE, 12 IN. LONG WITH UPPER CORNERS ROUNDED TO 1-IN. RADIUS, LOWER OUTSIDE CORNER TO 2-IN. RADIUS
52. DASHBOARD, ¾-IN. PLYWOOD
53. SOFT-IRON RIVETS, ⅛ x ¾ IN. EXACT LENGTH DEPENDS ON WIDTH OF SHAFT COLLAR USED
54. STEERING CRANK
55. SHAFT COLLAR, ½ IN. NOTE THAT PARTS NO. 54 AND 55 ARE JOINED WITH RIVETS, PART NO. 53
56. NO. 8 WOOD SCREW 1½ IN. LONG
57. STEERING COLUMN, ½ IN. DIA., 18 IN. LONG, STEEL SHAFTING
58. STEERING-COLUMN SUPPORT, ¾-IN. PLYWOOD
59. STEERING-COLUMN BRACE
60. SCREWEYE, ½ IN. TWO REQUIRED. TAKES SWIVEL SNAP ON TOP STRAP
61. FRONT PIECE, BODY
62. SHEET-METAL SCREW, SIZE ½—8 (OR 10), BINDER HEAD, FIVE REQUIRED
63. CORNER IRON, 1 IN., FIVE REQUIRED TO ATTACH BODY TO FRAME. EIGHT REQUIRED FOR JOINING THE FOUR PARTS OF BODY
64. DRIVING AND DRIVEN V-PULLEYS, DRIVING PULLEY, 2 IN. DIA., ⅝-IN. BORE. DRIVEN PULLEY, 10 IN. DIA., ½-BORE. USE ½-IN. V-BELT, 34 IN. LONG
65. TURNBUCKLE, SIZE (CLOSED) 5¼ IN. HOLDS MOTOR IN FIXED POSITION
66. AUTO GENERATOR, 6-VOLT. SERVES AS MOTOR WITHOUT ANY ALTERATION
67. CARRIAGE BOLTS, ¼ x 1½ IN. FOUR REQUIRED WITH HEX NUTS AND WASHERS
68. CHARGER, 12-VOLT
69. TURNBUCKLE, PART NO. 65, IS FITTED WITH NUTS AND LOCK WASHERS TO PREVENT IT FROM LOOSENING
70. BACK PIECE, BODY, ⅜ x 6 5/16 x 15 3/16-IN. PLYWOOD
71. SIDE PIECE, BODY. TWO REQUIRED. ONLY ONE HAS OPENING FOR BELT ADJUSTMENT
72. BUTT HINGE, 1½-IN., TWO REQUIRED
73. BEARING, TOP END OF STEERING COLUMN
74. SCREW, 10-24, 1 IN. LONG
75. CORNER IRONS, 1-IN. AND 3-IN. SIZES, TWO REQUIRED OF EACH
76. REAR FENDER, ⅜ x 4 x 12-IN. PLYWOOD WITH THREE CORNERS ROUNDED TO 1-IN. RADIUS
77. RUBBER HOSE, ⅝-IN. O.D.
78. STEERING WHEEL, ½-IN. BORE, 10¼-IN., DIA., CAST-IRON V-PULLEY
79. SHAFT COLLAR, ½-IN.
80. ELECTRICIAN'S BLACK PLASTIC TAPE
81. SIDE OF SEAT, TWO REQUIRED
82. SEAT BOTTOM, ⅜-IN. PLYWOOD. MEASURES 8¼-IN. WIDE, 21⅞-IN. ON LONG SIDE, 20 IN. ON SHORT SIDE. PADDED WITH CORRUGATED-RUBBER STAIR TREAD
83. SEAT BACK
84. MOTOR-COMPARTMENT COVER, OR DECK. ⅜ x 8¾ x 16-IN. PLYWOOD
85. DECK HANDLE
86. LEATHER STRAP, TWO REQUIRED WITH BUCKLES
87. STOPLIGHT, 12-VOLT
88. HOOK AND EYE, 3½ IN., HOLDS HINGED SEAT IN DOWN POSITION. EYE SCREWS INTO BACK OF SEAT NEAR BOTTOM. HOOK SCREWS INTO FRAME

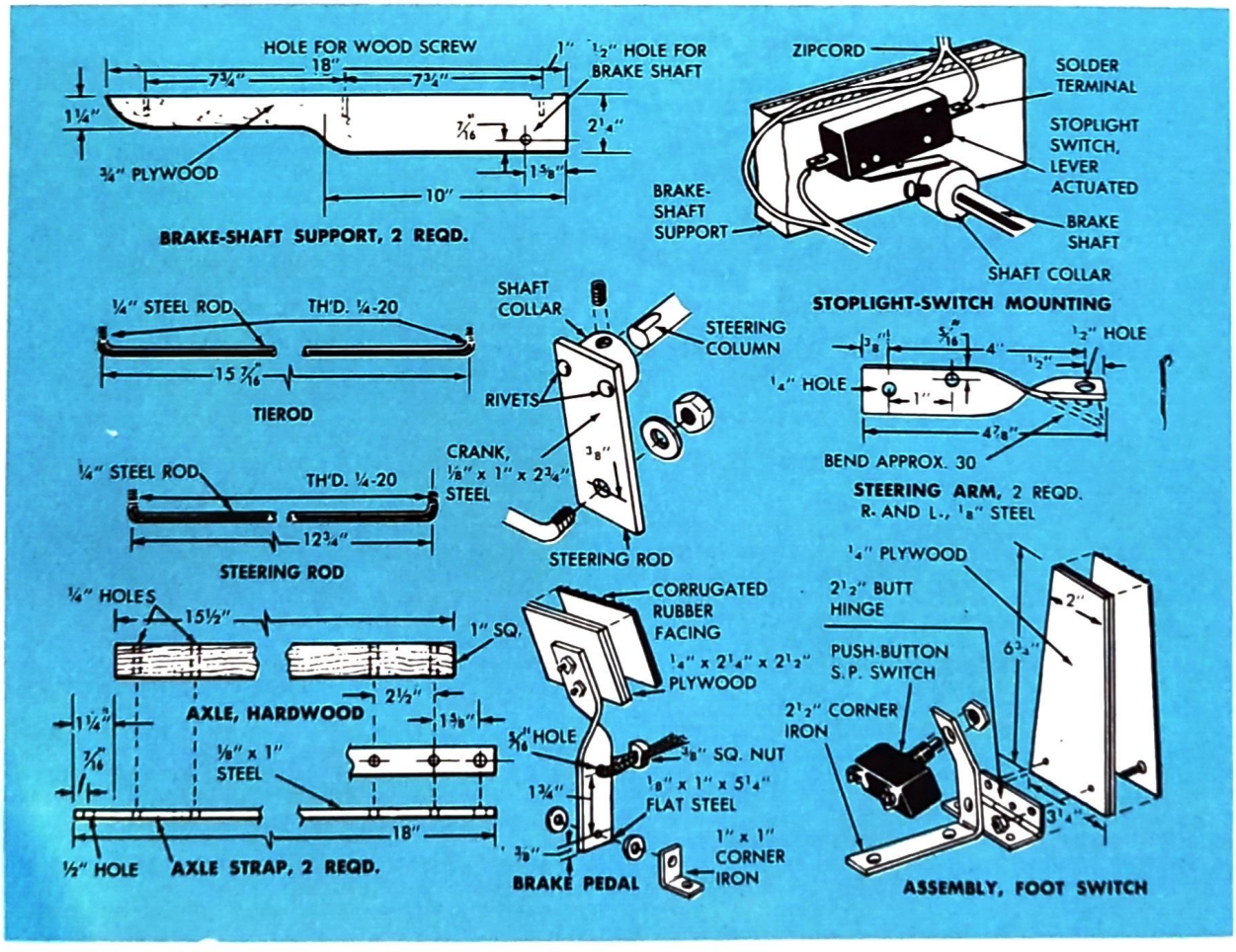
* PURCHASE A 24-IN. LENGTH OF DRILL ROD AND CUT TO REQUIRED LENGTH AFTER MAKING TRIAL ASSEMBLY. LENGTH MAY VARY FROM THAT GIVEN DUE TO POSSIBLE VARIATIONS IN WIDTH THROUGH PILLOW-BLOCK BEARINGS AND WHEEL HUBS

** INSIDE CORNER IRONS ARE USED THROUGHOUT ASSEMBLY. ALL 1-IN. IRONS JOINING BODY PARTS ARE HELD WITH 10-24 SCREWS AND SQUARE NUTS



Battery-powered headlights snap onto metal brackets attached to the dashboard. The brackets come with the lamps. Note also the construction of the front axle and the steering-knuckle assembly





The brake band is a ½-in. V-belt anchored to a stationary lug and a tightener, and passes around a V-pulley on the axle. Note the two studs which engage the wheel

view that there are three pairs of bolts that pass through the axle, the two kingbolts, the pair of carriage bolts holding the frame to the axle, and a pair of machine bolts that hold the three parts of the axle together. The wheel spindles swing on the kingbolts, which pivot ¼-in. pipe tees. Threads in the body of the latter are reamed out to take the kingbolts in a close fit. A hex nut, lock washer and a steering arm are placed on each spindle before turning the latter into the threaded stem of each tee. You'll see the order of assembly in the pull-apart view. A shaft collar with setscrews holds each wheel.

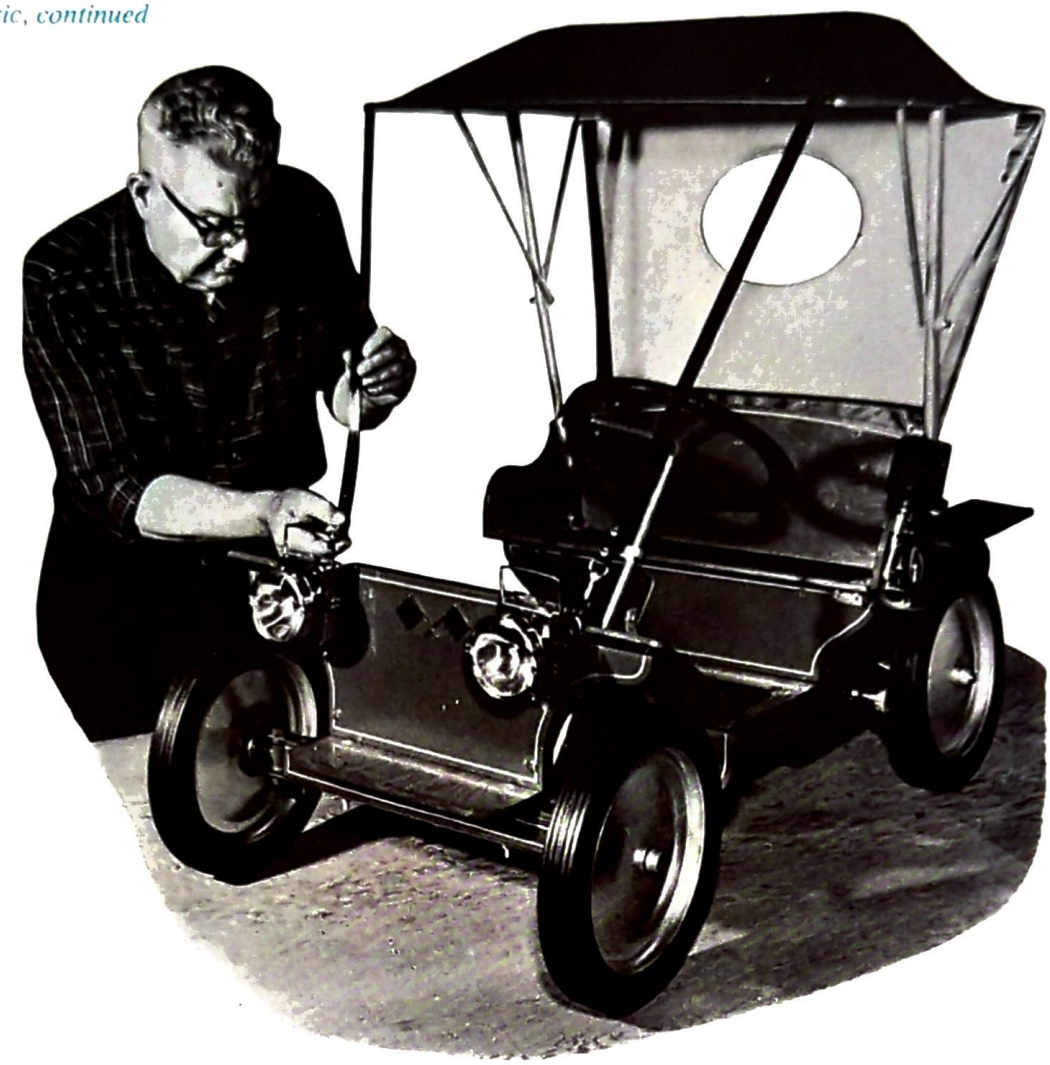
Assemble the rear axle in its bearings on the frame. Then make the brake-shaft supports and screw them in place on the underside of the frame, noting that the one that is grooved for the brake-band lug goes on the right side of the frame, viewed from the front. The complete brake assembly is shown pulled apart. There are two points to note especially in this assembly. First, the brake-band lug, part No. 38, drops into the groove in the brake-shaft support. The wood screw holding it in the groove passes through the frame from the top. side, through the lug and is turned into the brake-shaft support. The inner end of the lug is held by a 10-24 screw (with nut) which passes through a hole in the frame. This hole must be drilled through the frame after the parts are located. Second, the screw holding the forward end of the brake band in the groove in the brake-band tightener, part No. 36, passes through the band and a hole in the tightener and shaft.

Parts of the brake-eccentric assembly are shown on page 503. A 5/16 x 1⅜-in. stud is cross-drilled near the unthreaded end to take the end of the brake cable. A nut and washer are run down on the stud and the cross-drilled end inserted in a hole drilled through one side of the pulley (eccentric) rim. The free end of the cable is passed through the hole near the end of the stud and the nut tightened, clamping the end of the cable securely in place. This arrangement provides adjustment of the brake-cable length when the assembly is complete. The return spring is attached to the stud with a second nut and washer and the opposite end of the spring attaches to an anchor on the bottom of the frame.

Note now the similarity between the ground-wheel drive, and the brake assembly. Both make use of short studs, the unthreaded ends of which enter holes drilled through the inner half of the wheel webs. Two studs are required for the brake but only one for the drive.

The steering gear is of simple construction and consists of the tie rod, steering-rod, crank,

build the sidewalk classic, continued

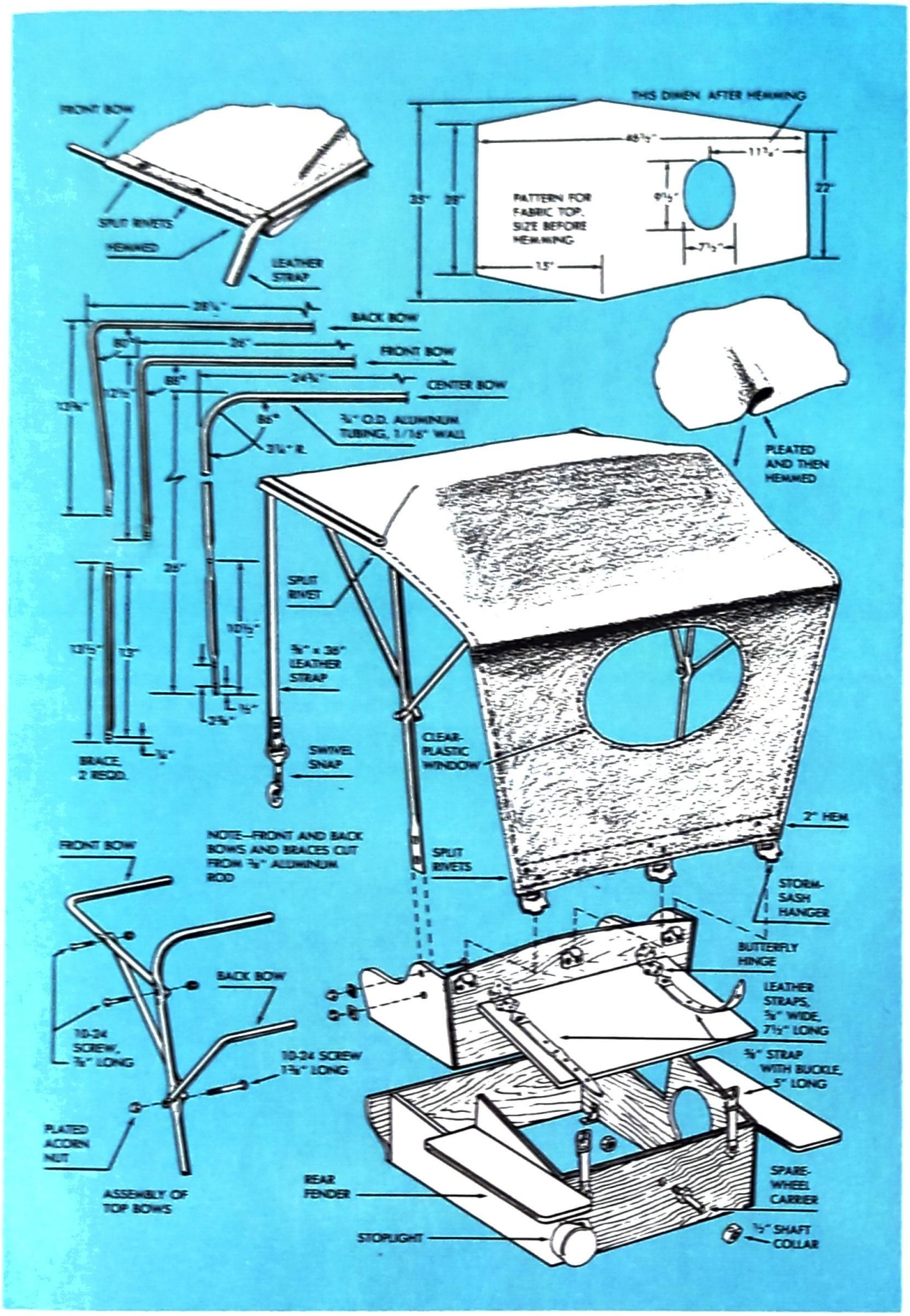


Swivel snaps riveted to the ends of straps hook into screweyes in the top edge of the dash

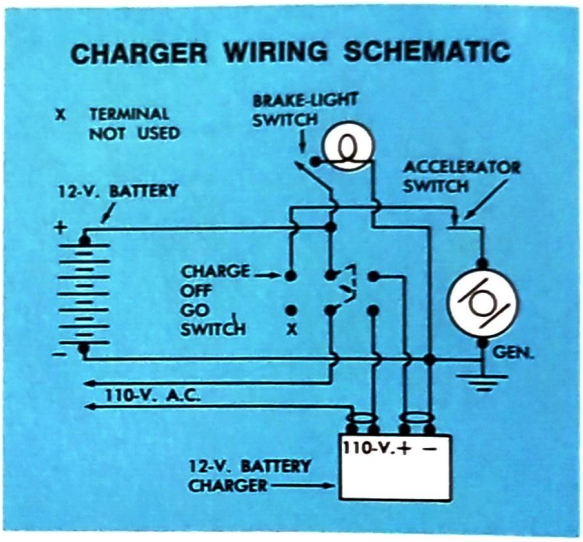
the column, column support, brace and wheel. The latter is a 10¼-in.-diameter V-pulley, the V-groove being filled with a ⅝-in.-diameter rubber hose and then wrapped with electrician's plastic tape. This makes a neat, realistic wheel rim. When assembling the steering gear you may need to make some adjustment in the "geometry" by bending the arms so that the front wheels toe correctly.

The body also is of the simplest construction, made entirely of ⅜-in. plywood and joined with 1-in. corner irons, each held in place with two 10-24 screws and square nuts. Parts for the seat are assembled in the same manner, using the same size irons and screws. The one exception in this procedure is the method of joining one leg of each corner iron holding the body to the frame. Here a No. 8 or 10 sheet-metal screw ½ in. long (part No. 62) is used instead of a 10-24 screw and nut to join the leg of the iron to the frame. Dimensions of the seat bottom, fenders and hinged rear deck, or cover, will be found in the parts list. Rear fenders are joined to the body with corner irons (parts No. 75) and 10-24 screws and nuts. Front fenders are attached to dashboard and fender support with 1½-in. No. 8 screws.

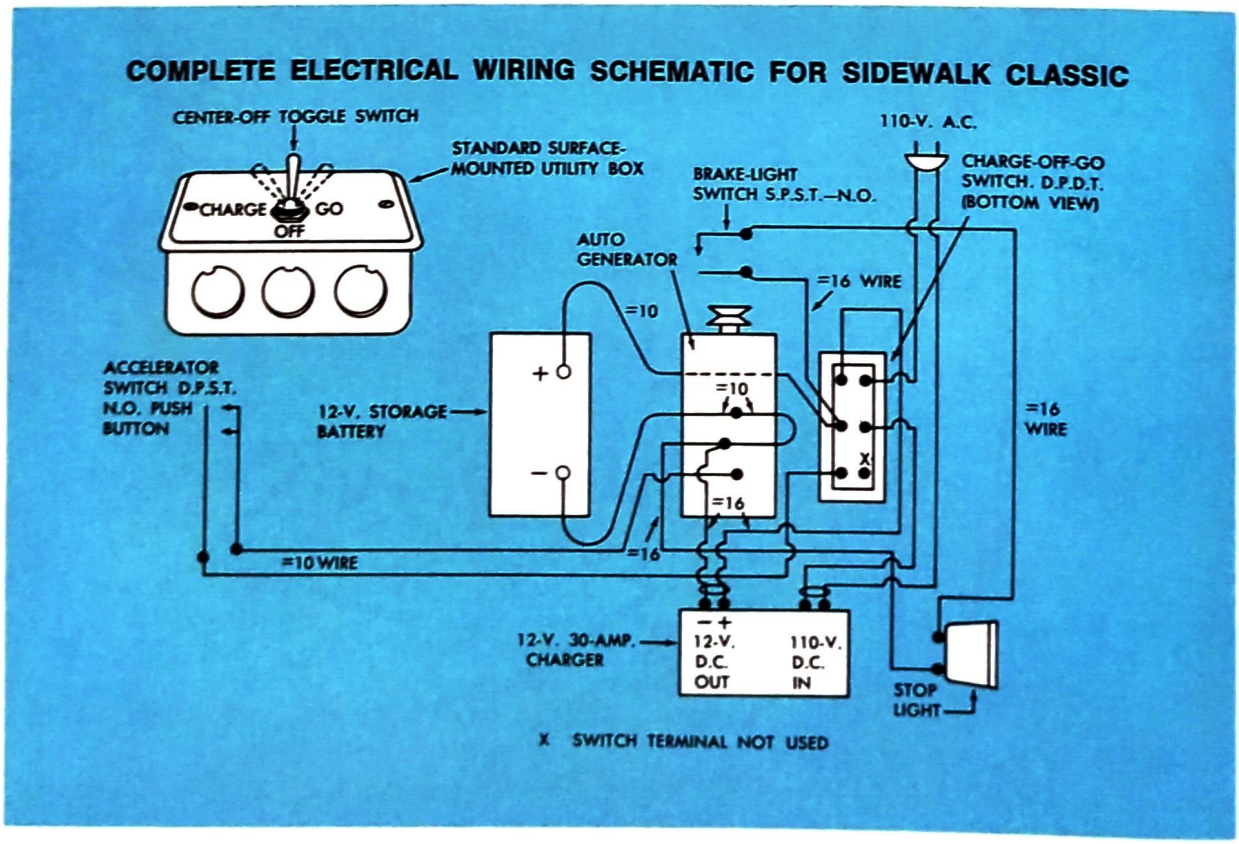
Next step is to add the top and install the wiring. The top, authentic in appearance, consists of a metal frame covered with an artificial-

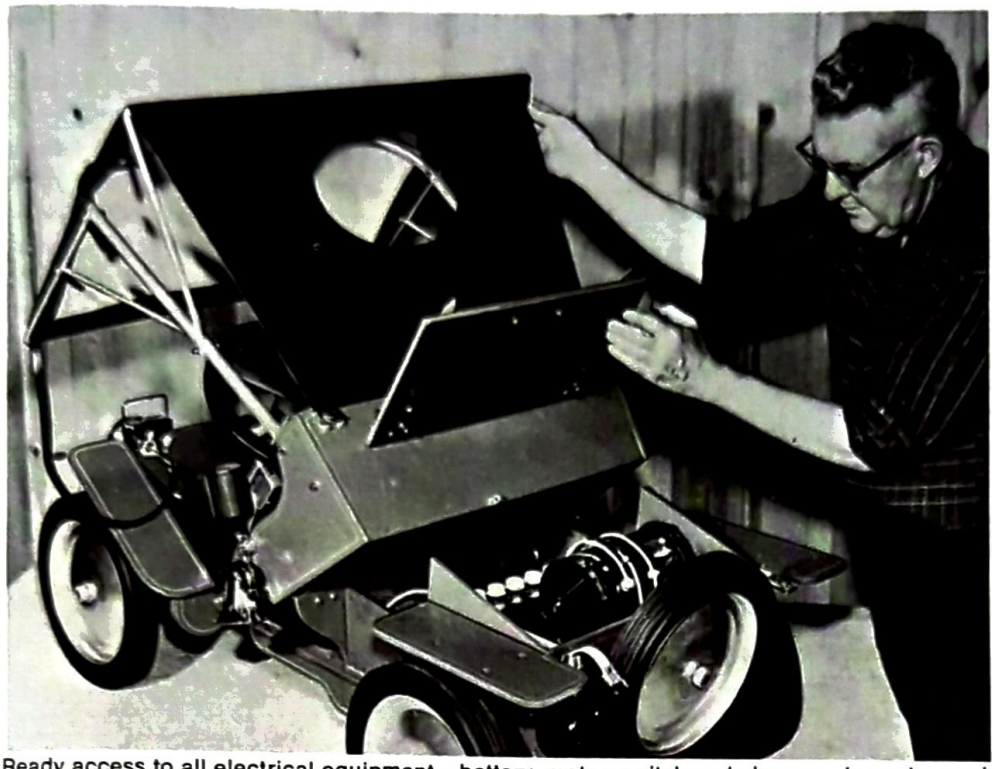

FRONT BOW
SPLIT RIVETS
HEMMED
LEATHER STRAP
THIS DIMEN. AFTER HEMMING
PATTERN FOR FABRIC TOP. SIZE BEFORE HEMMING
BACK BOW
FRONT BOW
CENTER BOW
¾" O.D. ALUMINUM TUBING, 1/16" WALL
PLEATED AND THEN HEMMED
SPLIT RIVET
⅝" x 38" LEATHER STRAP
SWIVEL SNAP
BRACE, 2 REQD.
CLEAR-PLASTIC WINDOW
2" HEM
NOTE—FRONT AND BACK BOWS AND BRACES CUT FROM ¾" ALUMINUM ROD
SPLIT RIVETS
STORM-SASH HANGER
BUTTERFLY HINGE
LEATHER STRAPS, ⅝" WIDE, 7½" LONG
⅝" STRAP WITH BUCKLE, 5" LONG
10-24 SCREW, ⅞" LONG
10-24 SCREW 1⅝" LONG
PLATED ACORN NUT
ASSEMBLY OF TOP BOWS
REAR FENDER
SPARE-WHEEL CARRIER
STOPLIGHT
½" SHAFT COLLAR

Assemble the top before placing it on the car. The metal frame, consisting of front, back and center bows, and braces, is made from aluminum rod and tubing that is available in all hardware, building supply, and hobby stores



ild the sidewalk classic, continued





Ready access to all electrical equipment—battery, motor, switch and charger—is made possible by the hinged seat, top and deck, which tilt forward. The seat is held down with a hook

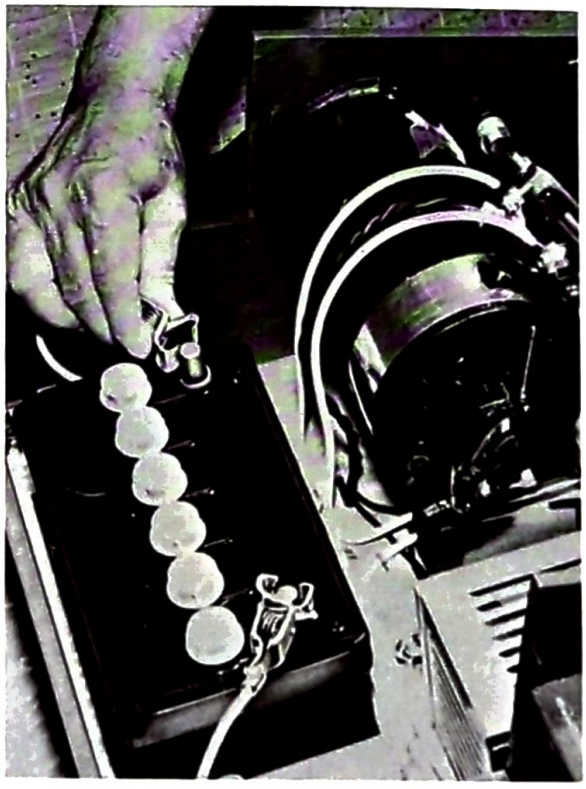
leather fabric, the pattern for which is given on page 509. Overall measurements before hemming are shown with the exception of one dimension, from the rear window opening to the bottom of the back flap, which is given after hemming.

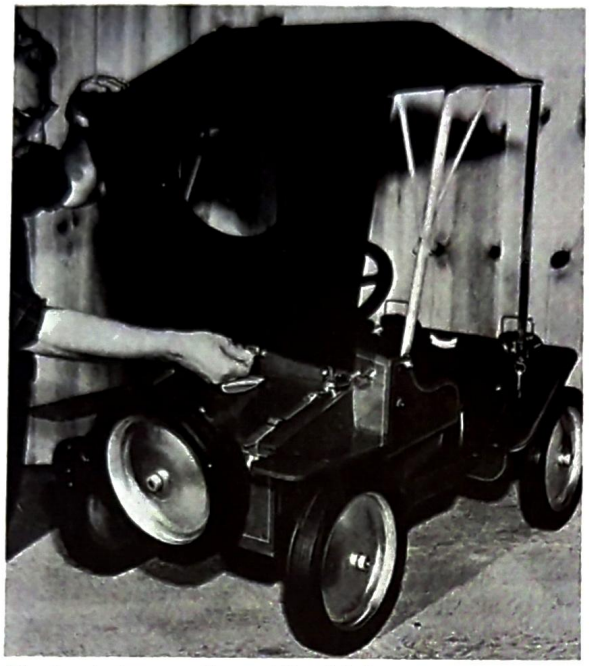
Don't cut the fabric until after you have made and assembled the bows and braces. You can bend the center bow by hand, but you run the risk of getting an uneven bend and spoiling the contour of the roof as a result. Instead, borrow an electrician's conduit bender for this job. After bending, flatten at the points indicated and drill holes for the bolts. Then bend the front and back bows, flatten the ends slightly, and also drill the holes for the bolts.

The holes in the front bow for the bolts that hold the upper end of the braces are located and drilled after a trial assembly.

Now refer to the drawing on page 509 for the location of the holes for the bolts holding the center bow to the ends of the seat. Drill these holes and mount the assembled bows temporarily so that you can more easily fit the fabric top. Lay the fabric over the bows and determine the location of the pleats, or tucks, and the amount to be turned under for the hems. This done, sew

The electricals are housed in the body, with the battery in a well under the seat. Note the position of the charger and the "off-go-charge" switch. Note also the use of snap-on terminal clamps on the battery





The back drop, or flap, of the fabric top is attached to the back of the seat with storm-sash hangers. The rear window is fitted with a sheet of clear plastic

build the sidewalk classic, continued

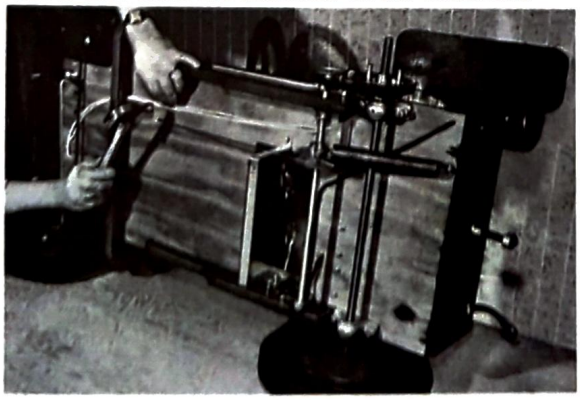
the hems all around, making the pleats as you go. Cut the opening for the rear window. Cut thin, clear plastic about ½ in. larger all around than the opening and sew in place. After pleating and hemming, fold the forward end of the fabric around the front bow and fasten with split rivets. Note that the leather straps are attached to the top with split rivets at the pleats and at the front edge of the fabric. Attach a swivel snap to the free end of each strap, fastening with split rivets.

The back drop, or flap, of the top attaches to the back of the seat with three storm-sash hangers. Note that the sash half of the hanger is riveted to the lower edge of the fabric, while the other half of each hanger is attached to the back of the seat with 10-24 screws and hex nuts.

Note that when everything is assembled the hinged seat, deck and top tip forward to give access to the electricals, motor, battery, charger and the off-run-charge switch. The exact location of the switch and charger is of no importance; place them so there is access to each.

When wiring, follow the wiring diagram which gives the wire sizes to use. Wires from the start-stop, foot-controlled switch and to the stoplight switch are stapled to the underside of the frame. Before making the test run, be sure you have the correct tension on the driving V-belt and that all nuts and screws have been properly tightened. The fifth, or spare, wheel pictured is optional. The carrier is simply a threaded ½-in. stud and shaft collar installed on the back body panel. Brackets for the headlights (the brackets come with the units) are screwed to the dashboard as shown.

The wiring from the foot-operated switch and the stoplight switch is stapled to the underside of the frame. Wire sizes are indicated on the schematic



colors are optional

Paint colors are optional. The original pictured was painted a bright red with a silver striping, an attractive combination. The top of the plywood frame was finished in natural color. The disk wheels were sprayed with silver paint.

There are some interesting decorative touches that you can add which will increase the authentic look and at the same time make the car more fun to own. For example, if you shop around, you should be able to find one of those old rubber-bulb operated auto horns. If you can find one with a shiny brass bell, so much the better.

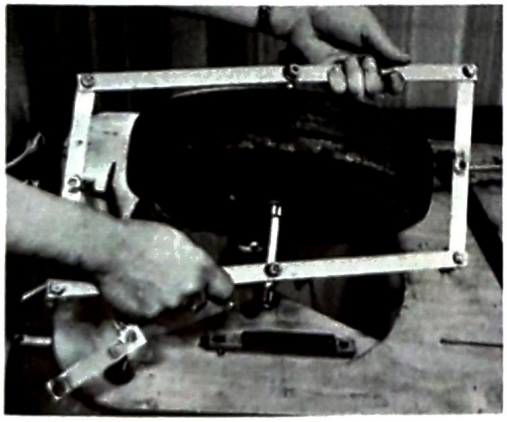
The same material you used to make the top would serve very well as a covering fabric if you chose to upholster the seats. You wouldn't have to be fancy. Just cover the wooden seat and back with 1 or 1½-in. of foam rubber, cover with the fabric, then tack to the edges of the seat. Use large-headed colored upholstery nails. For a final touch of authenticity, drive some of these nails into the back and the seat in a grid pattern, with about 6 in. between nails, to imitate the old upholstery buttons.

See also: bicycles; cars, midget; stage coach; train, children's; unicycle.

Build an electric Scoot-car

Designed by ROBERT WOOLSON

Here's a sidewalk special for young hotrodders that safely takes the corner on two wheels, has two forward speeds and brakes that stop on a dime



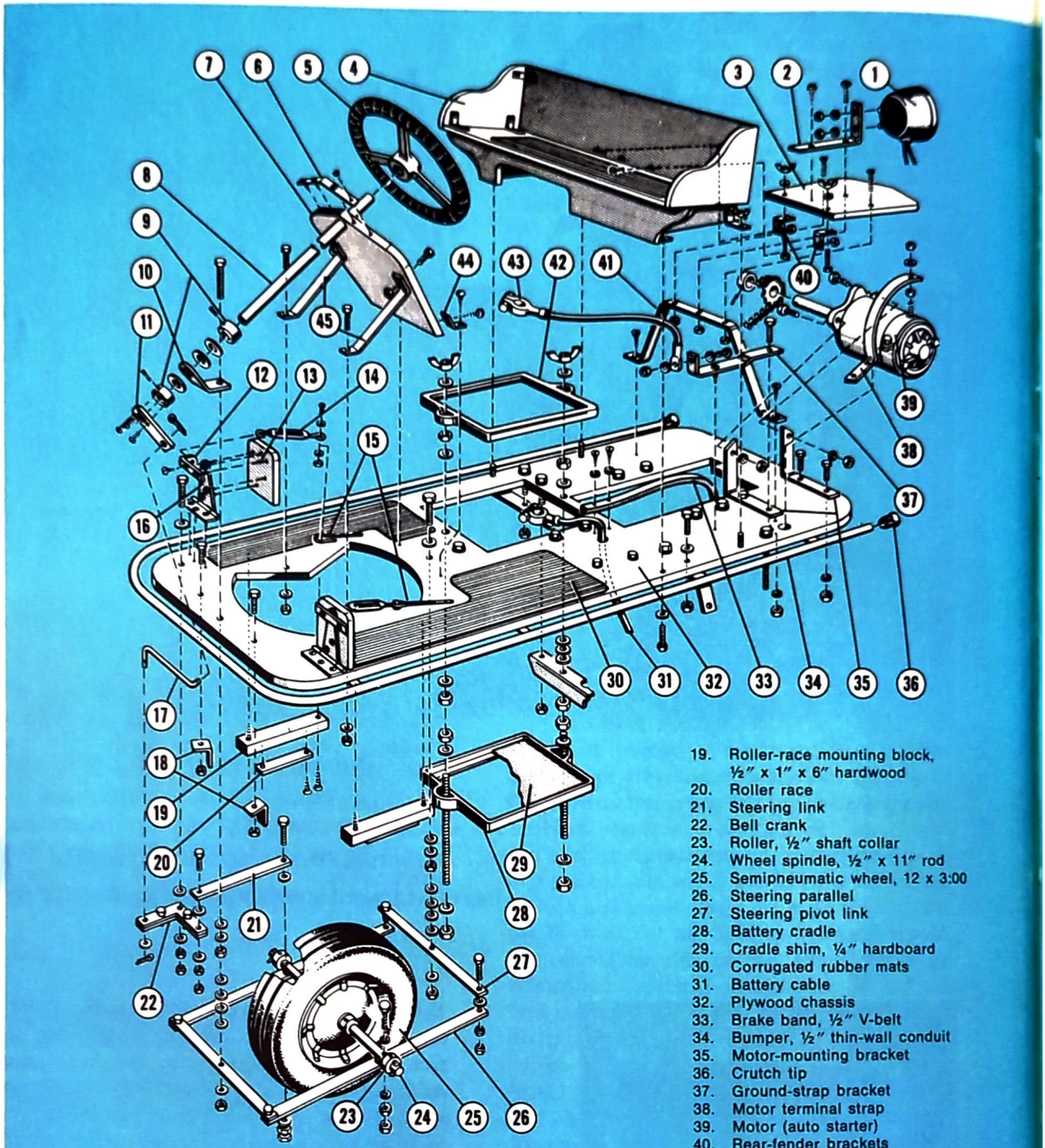
This is the parallel-arm steering gear being placed in position. Pivot links are bolted to the deck, using washers and locknuts

ONE FULL BATTERY CHARGE readies Scoot-car for hours of fun. Cornering wheels, one on each side of the chassis, give the driver sure stability from a standing start, and a near top speed of 10 to 12 miles per hour puts the car up on two wheels where it steers and controls like a car, but rides like a speedy low-slung scooter.

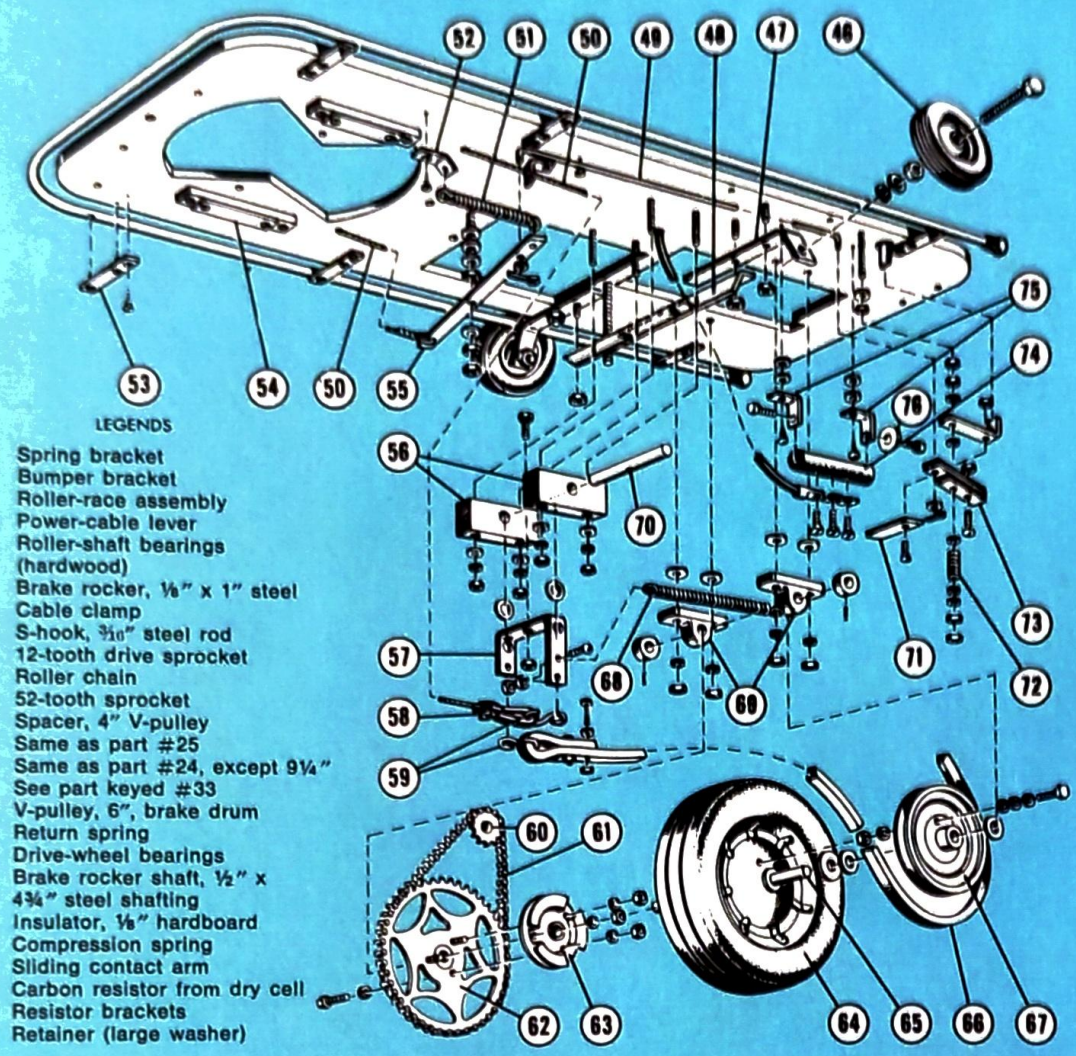
When cornering, the car leans over on one or the other of the outrider wheels, enabling the driver to keep safe, full control when turning. Power and brake application are controlled by pedals with strong return springs. Release the power pedal, hit the brake hard and Scoot-car stops within its length of 4 ft.

Caution: While Scoot-car is a safe toy

build a Scoot-car, continued

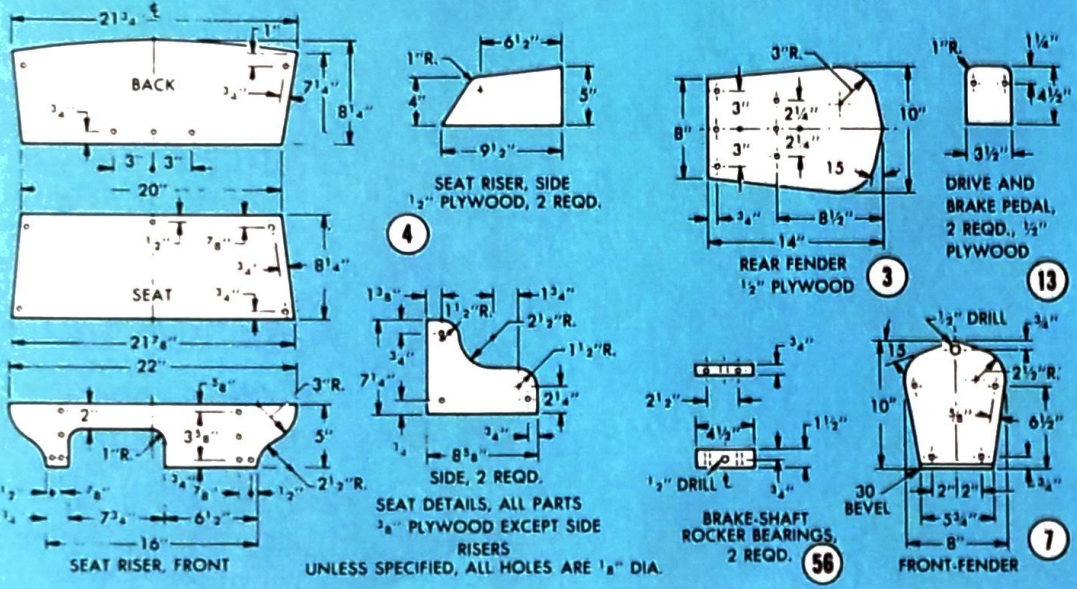


1. Taillight (optional)
2. Taillight bracket
3. Rear fender
4. Seat
5. Steering wheel
6. Front-fender trim (⅛″ x ½″)
7. Front fender
8. Steering post, ½″ x 25″ rod
9. Shaft collar, ½″ dia.
10. Lower bearing, steering post
11. Steering arm
12. Cable bracket
13. Drive pedal
14. Turnbuckle
15. Drive and brake cables
16. T-hinge, 3″ leaf
17. Tie rod, ¼″ steel rod
18. Steering limit bracket, ⅛″ x 1″ flat steel
19. Roller-race mounting block, ½″ x 1″ x 6″ hardwood
20. Roller race
21. Steering link
22. Bell crank
23. Roller, ½″ shaft collar
24. Wheel spindle, ½″ x 11″ rod
25. Semipneumatic wheel, 12 x 3:00
26. Steering parallel
27. Steering pivot link
28. Battery cradle
29. Cradle shim, ¼″ hardboard
30. Corrugated rubber mats
31. Battery cable
32. Plywood chassis
33. Brake band, ½″ V-belt
34. Bumper, ½″ thin-wall conduit
35. Motor-mounting bracket
36. Crutch tip
37. Ground-strap bracket
38. Motor terminal strap
39. Motor (auto starter)
40. Rear-fender brackets
41. Rear-fender support
42. Battery cradle
43. Battery cable
44. Fender bracket
45. Fender brace
46. Semipneumatic wheel, 6 x 1:50
47. Wheel bracket
48. Chassis cross brace
49. Control rod (pedal to switch)
50. Drive and brake cables
51. Return spring

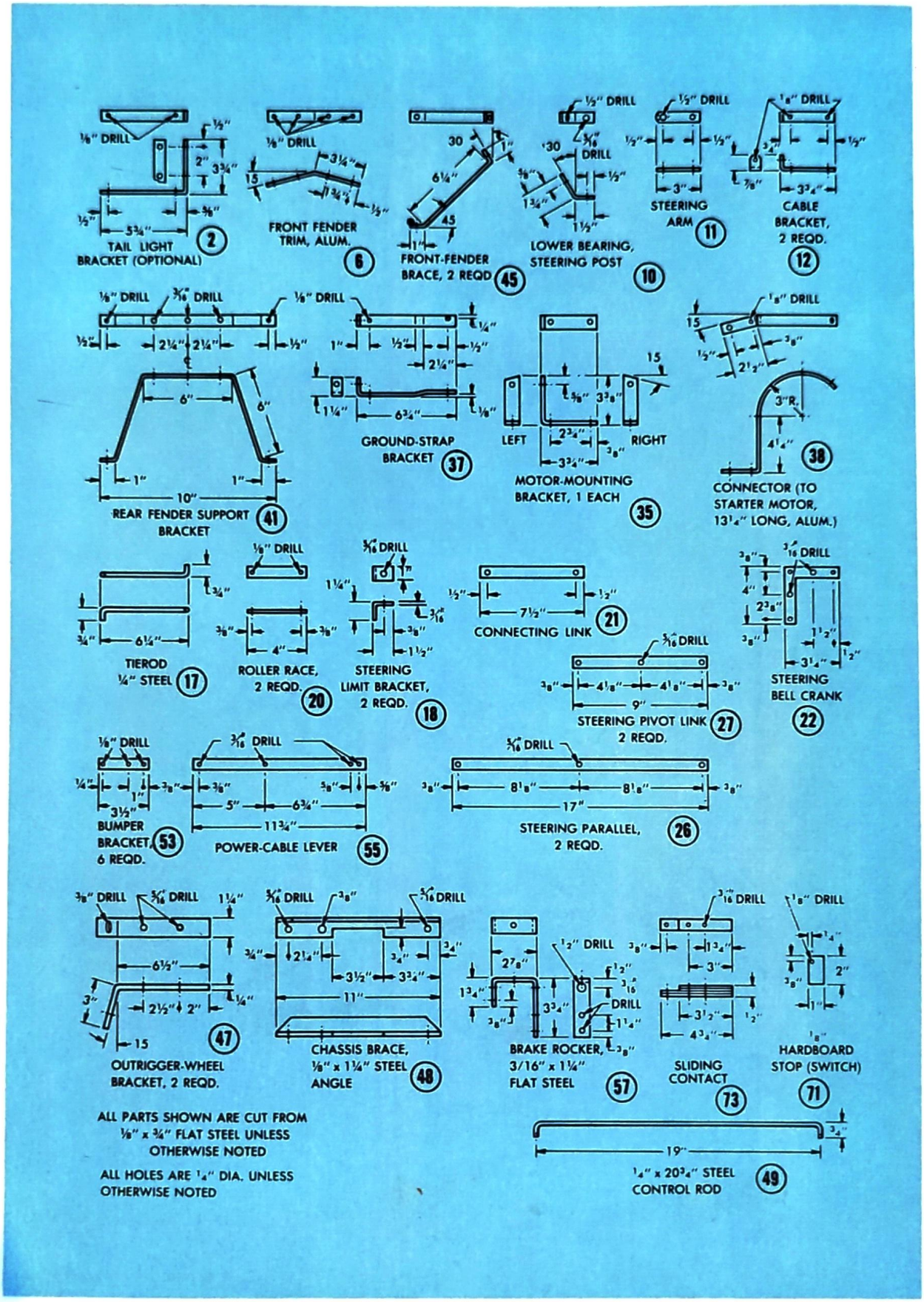


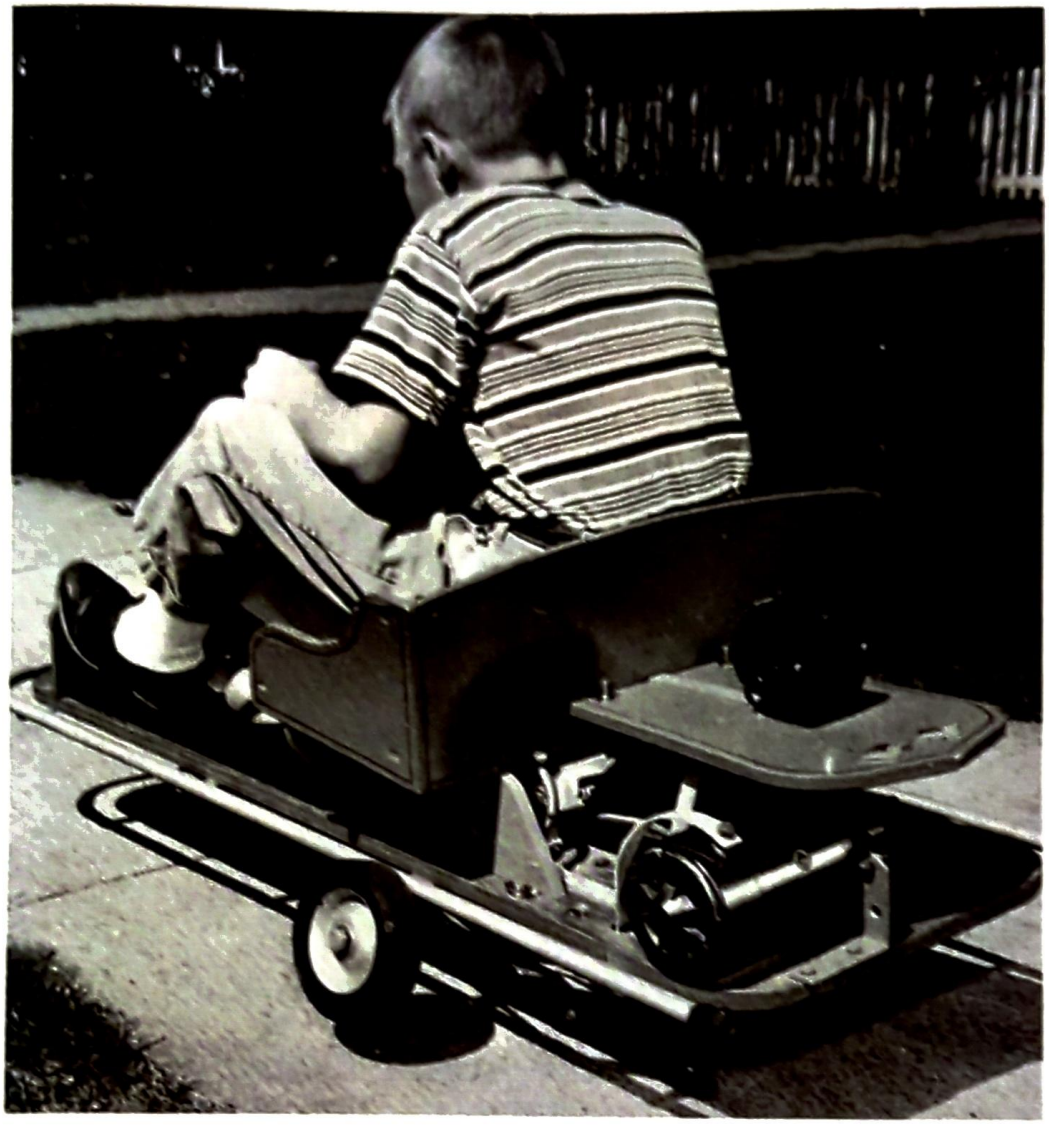
LEGENDS

52. Spring bracket
53. Bumper bracket
54. Roller-race assembly
55. Power-cable lever
56. Roller-shaft bearings (hardwood)
57. Brake rocker, ⅛" x 1" steel
58. Cable clamp
59. S-hook, 3/16" steel rod
60. 12-tooth drive sprocket
61. Roller chain
62. 52-tooth sprocket
63. Spacer, 4" V-pulley
64. Same as part #25
65. Same as part #24, except 9¼"
66. See part keyed #33
67. V-pulley, 6", brake drum
68. Return spring
69. Drive-wheel bearings
70. Brake rocker shaft, ½" x 4¾" steel shafting
71. Insulator, ⅛" hardboard
72. Compression spring
73. Sliding contact arm
74. Carbon resistor from dry cell
75. Resistor brackets
76. Retainer (large washer)



build a Scoot-car, continued

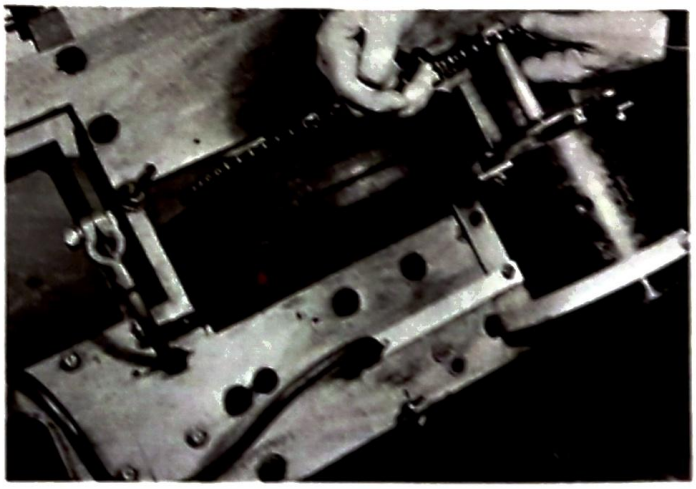

TAIL LIGHT BRACKET (OPTIONAL) 2
FRONT FENDER TRIM, ALUM. 6
FRONT-FENDER BRACE, 2 REQD 45
LOWER BEARING, STEERING POST 10
STEERING ARM 11
CABLE BRACKET, 2 REQD. 12
REAR FENDER SUPPORT BRACKET 41
GROUND-STRAP BRACKET 37
MOTOR-MOUNTING BRACKET, 1 EACH 35
CONNECTOR (TO STARTER MOTOR, 13¼" LONG, ALUM.) 38
TIEROD ¼" STEEL 17
ROLLER RACE, 2 REQD. 20
STEERING LIMIT BRACKET, 2 REQD. 18
CONNECTING LINK 21
STEERING PIVOT LINK 2 REQD. 27
STEERING BELL CRANK 22
BUMPER BRACKET, 6 REQD. 53
POWER-CABLE LEVER 55
STEERING PARALLEL, 2 REQD. 26
OUTRIGGER-WHEEL BRACKET, 2 REQD. 47
CHASSIS BRACE, ⅛" x 1¼" STEEL ANGLE 48
BRAKE ROCKER, 3/16" x 1¼" FLAT STEEL 57
SLIDING CONTACT 73
HARDBOARD STOP (SWITCH) 71
¼" x 20¾" STEEL CONTROL ROD 49
ALL PARTS SHOWN ARE CUT FROM ⅛" x ¾" FLAT STEEL UNLESS OTHERWISE NOTED
ALL HOLES ARE ¼" DIA. UNLESS OTHERWISE NOTED

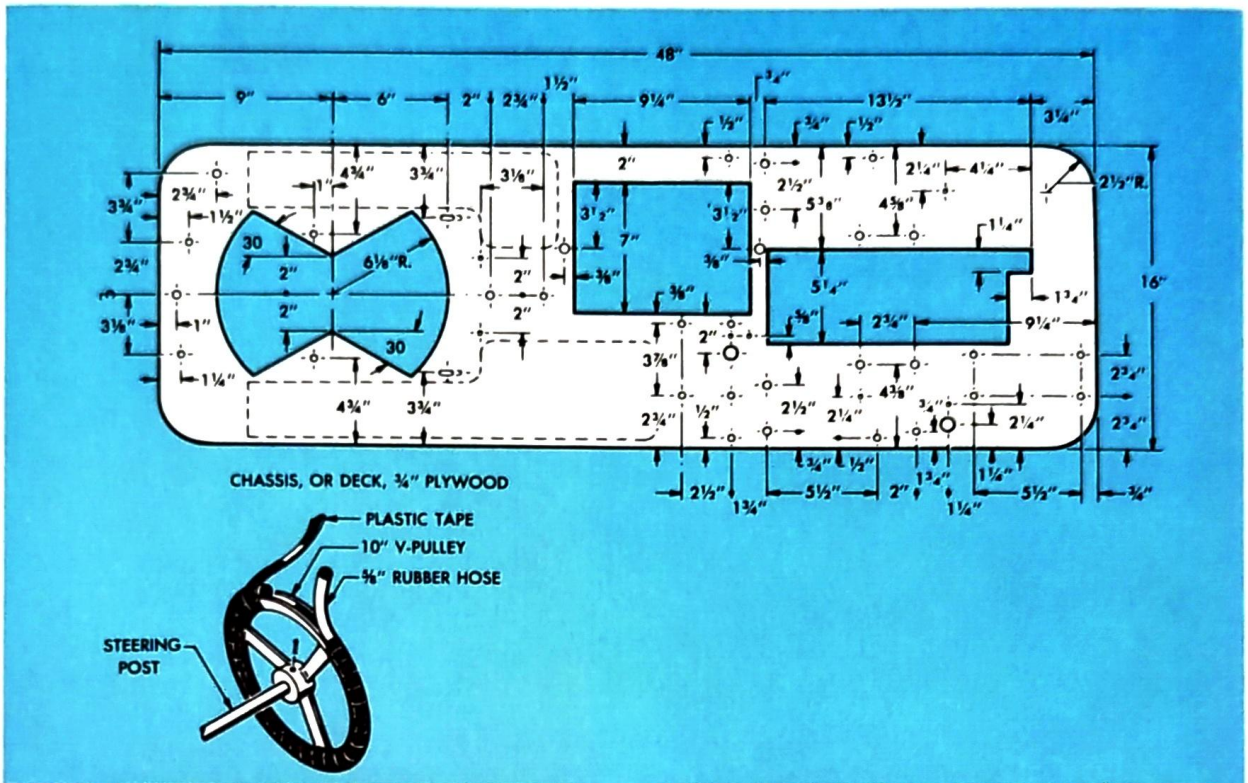


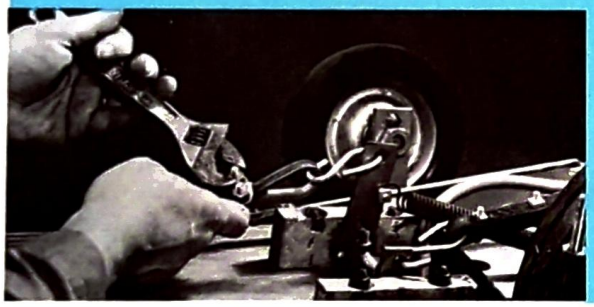
mechanically, there are precautions to observe in riding. When operating it for the first time, the immediate reaction to tipping is to take the feet off the pedals and plant them on the ground. With the car in motion, this can pitch the rider forward. The outrider wheels, of course, make tipping over impossible, and after a few trial spins, the rider will overcome the tendency to brace himself and will keep his feet on the pedals.

Looking over the details you will see that Scoot-car has a unique parallel-arm steering gear and a positive roller-chain drive from an auto-starter motor. Throughout the construction, full use is made of standard, readily available parts and materials wherever possible. For example, the steering wheel is a 10-in.-diameter spoked V-pulley, wrapped with electrician's tape over a length of hose set into the V-rim of the pulley.

The roller-chain assures positive drive from the motor to the ground wheel. Slack in the chain should not exceed ½ in. Note the position of the battery cables and of the ground and power straps on the board







The brake cable is attached to the brake rocker with a cable eye and clamp. Note the end of the brake band bolted into a loop and attached to an S-hook

The free end of the V-belt brake band is bent back on itself to form a loop taking one eye of an S-hook. The loop is secured by two bolts

This makes a neat, attractive wheel of just the right size.

Make the plywood chassis (part No. 32) first, cutting the three openings for front and rear wheels and battery cradle as the first step. These openings should be cut just inside the pattern lines and then smoothed out to the lines with a wood rasp. Round corners slightly and sand smooth. Round the corners of the chassis to the radius indicated and sand all edges. Then lay out the hole pattern and centermark the location of holes with an awl. All smaller holes indicated are ¼ in. in diameter. Those for the battery-cradle studs are ⅜ in. in diameter to take ⅜-in. threaded rod. Holes taking the rear-wheel bearing bolts are 5/16 in. in diameter and the two largest holes indicated take the battery cable and motor-terminal strap and are each ¾ in. in diameter. The two holes, indicated as elongated, take the brake and power-control cables and are drilled ¼ in. in diameter and at as steep an angle as possible, then enlarged with a round file so that the cables clear without binding.

Next comes installation of front and rear wheels. Take the front wheel first and begin by noting closely the relationship of the parts. The parallels and the pivot links are of flat steel (also often referred to as band iron) and are cut to length and drilled as detailed. The front wheel is centered on its spindle with shaft collars, and the outer ends of the spindle are carried on rollers, which are ½-in. shaft collars cotter-pinned on the shaft. The spindle is drilled just inside the collars (rollers) to take the ¼-in. capscrews which hold the parallels to the shaft. One screw is longer to take the steering link. Spacer washers

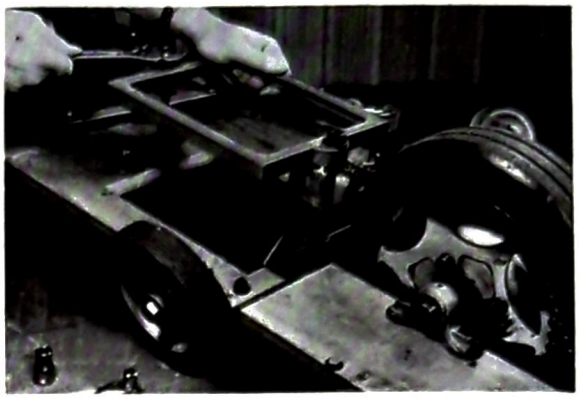
are placed between the joining parts and all screws carry additional washers and locknuts to permit free movement. In the assembly, the rollers on the ends of the wheel spindle ride on races made as shown. Each consists of a mounting block of hardwood and a facing of flat steel, and the two units are attached to the underside of the deck with wood screws. The pivot links are bolted to the underside of the deck and the steering, or connecting, link attaches to the bell crank. The latter is bolted to the underside of the chassis and the free arm takes the lower end of the tie rod when assembled. The upper end of the tie rod is attached to the steering arm on the lower end of the steering post. The steering arm is riveted to a shaft collar which provides a hub and a means of attaching to the steering post.

rear wheel attached next

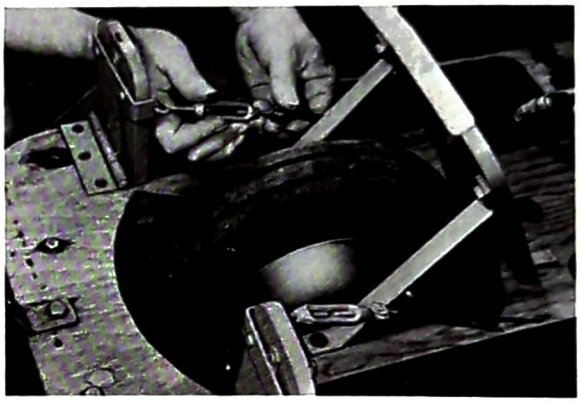
Now comes the rear wheel which is attached to the deck with two pillow-block bearings and carries the driven sprocket and brake drum. Notice especially the rear-wheel assembly. The brake drum is a V-pulley which slips onto the wheel spindle to which it is locked with its setscrew and additionally locked by a capscrew long enough to permit the threaded end to enter a hole drilled in the hub of the rear wheel. On the opposite side of the wheel a smaller V-pulley, with the rim cut away as indicated, serves as a spacer and a hub for the driven sprocket. It is locked to the hub of the rear wheel in the same manner as the brake drum. The brake band is a length of ½-in. V-belt, one end of which is attached to the top face of the deck with two wood screws. The other end is doubled back on itself to form a loop around an S-hook, the latter attaching to the brake arm.

The brake rocker is carried on a shaft supported in hardwood bearings bolted to the underside of the deck. The brake-return spring attaches to the long arm of the rocker and to one of the pillow-block bearing bolts. The second S-hook attaches to the long arm of the rocker and to a cable eye which connects to the 3/16-in. wire cable from the brake pedal. Note that turnbuckles are provided on both brake and power cables for adjustment.

The power-control cable reaches from the turnbuckle to one end of a pivoted lever. The other end of the lever connects to the control rod, part No. 49. The free end of the control rod is bent at right angles, drilled and cotterpinned to the sliding contact, part No. 73. The lever is returned by a spring, one end of which is hooked



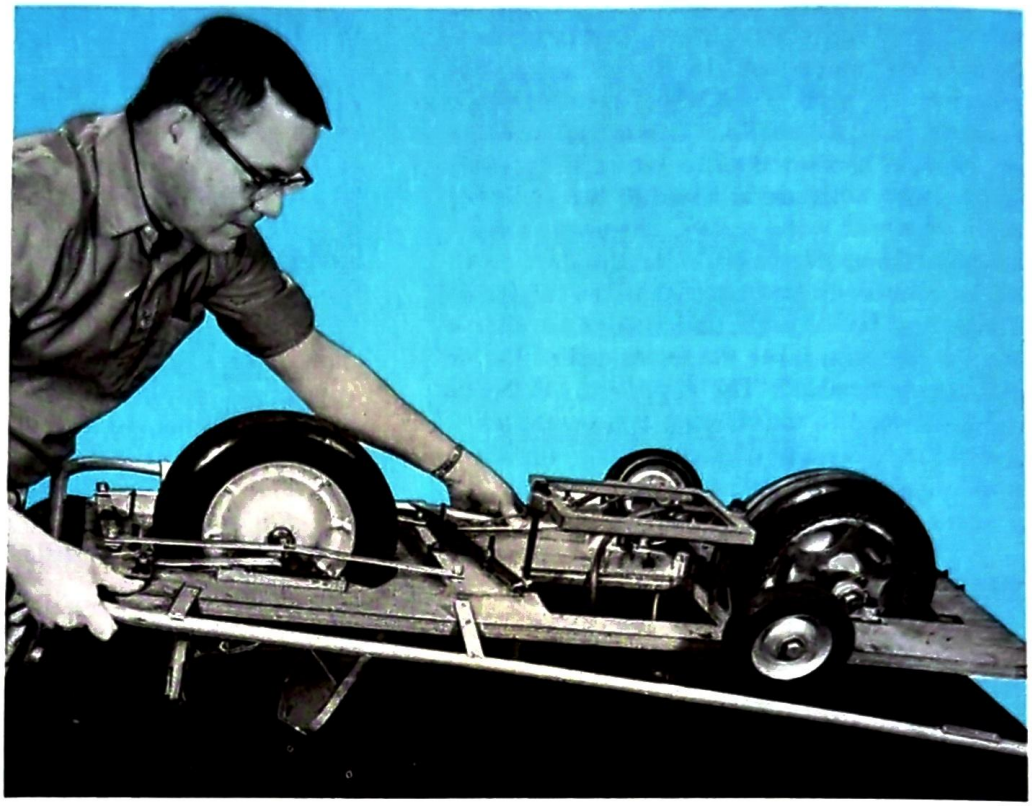
The lower half of the battery cradle or carrier is held in place by jam nuts. Be sure the nuts are tight



Turnbuckles provide adjustment on both the power and the brake cables

to a bracket screwed to the underside of the deck, see parts No. 51 and 52. The resistor, which is the carbon core from a dry cell, is mounted in brackets, parts No. 74 and 75, and is drilled and tapped for three ¼-in. flat-head screws and two ¼-in. capscrews, the latter holding it in place between the brackets. Drilling and tapping must be done with care, the tap holes being drilled slightly oversize so that the tap cuts only a 50- to 60-percent thread. One screw of the three shown takes the end of the battery cables, the other two, which are contacts through the resistor, are fitted with squares cut from 1/16 x ½-in. flat steel and center-countersunk to take the heads of the screws flush. In the off position the spring-loaded sliding contact arm contacts an insulating strip of hardboard, part No. 71, which is attached to the ground strap. This type of switch (in effect a rheostat) prevents heavy current surges and reduces arcing in the control switch to the minimum.

The motor-mounting brackets are made right and left and are so placed that the regular



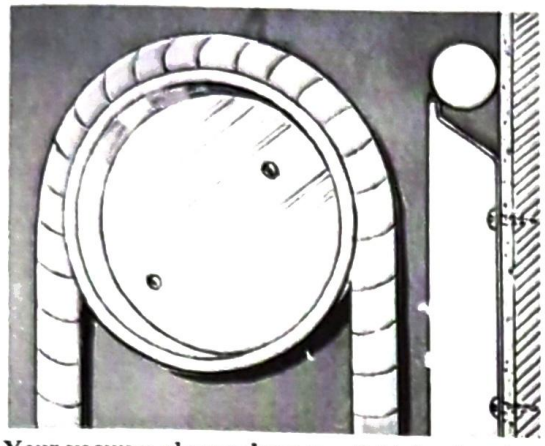
Scoot-car, continued

mounting lugs on the motor can be utilized as fastenings. Note especially how the aluminum ground strap from the motor terminal is bent so that it passes through the large hole in the chassis, the lower end being held in place by the bolt on which the sliding contact pivots. It will be noted that there is an L-shaped retainer attached to one of the brackets supporting the resistor. This has been lowered in the photo for clarity. It has, however, been replaced by a large washer, part No. 76. This retainer prevents the insulator, part No. 71, from swinging.

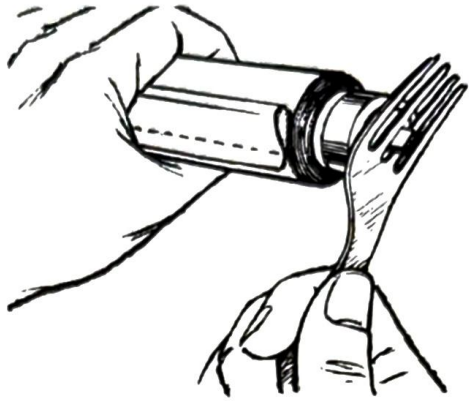
All parts of the seat except the risers are made from ⅜-in. plywood and all parts are joined with 1 x 1 x ½-in. steel corner angles which are readily available. Care must be taken when locating the front and side risers to see that the holes in the attaching corner angles register with those in the deck to which the seat is attached with bolts and wing nuts. Note also that the inner end of the rear fender is attached to the back of the seat with corner angles, small bolts and wing nuts. The front fender is bracketed and braced to the deck and serves not only as a front-wheel fender, but also as a support for the steering post, or column. The brake and power pedals consist of a 3-in. T-hinge and a pedal, or pad, of plywood, and a bracket which takes one eye of the turnbuckles. The hinge leaves are attached to the deck with wood screws.

The bumper is a length of ½-in. thin-wall conduit and is held in place with six flat-steel brackets screwed to the underside of the platform with wood screws and to the thin-wall conduit with self-tapping screws or sheet-metal screws. Rubber crutch tips are slipped on the open rear ends of the bumper. It may be attached either before or after the cornering wheels are in place. These wheels are carried at an angle of 15 deg. on heavy outrigger brackets bolted to the deck. Finally, install the steel-angle brace.

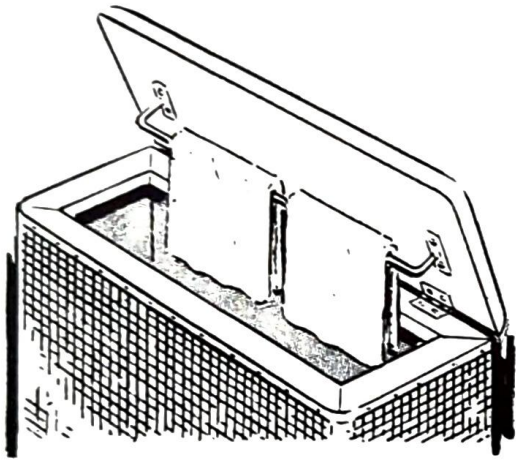
All that remains are installation of the battery cradle, the 6-v. battery and the foot and seat mats which are cut from corrugated-rubber stair treads and cemented to the deck. The taillight can be of the type pictured and detailed and wired into the power circuit, or you can use a battery-powered bike headlight and cover the lens with red cellophane. Also, you'll probably need to do some adjusting of the brake and power-cable turnbuckles to get the controls working right.



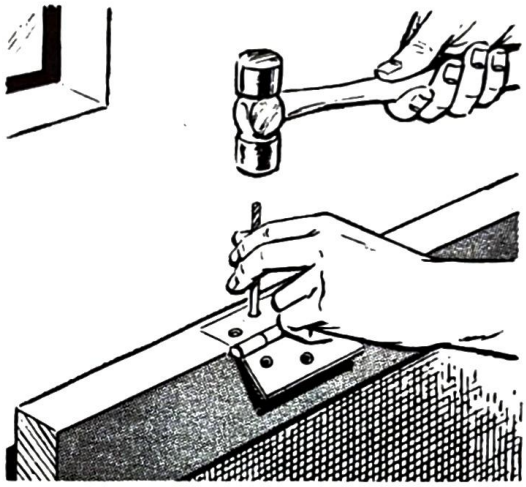
Your vacuum cleaner hose won't kink when it is stored, if you loop it over a deep-dish pie pan mounted on the wall.



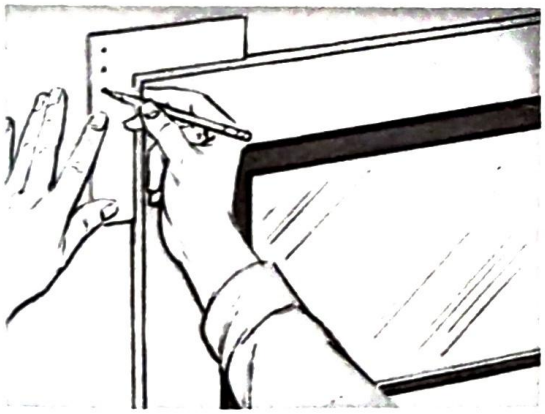
A common table fork is the perfect tool for increasing the spring tension in a window shade.



A light towel bar mounted on the underside of the top of your clothes hamper holds wet articles until washday.

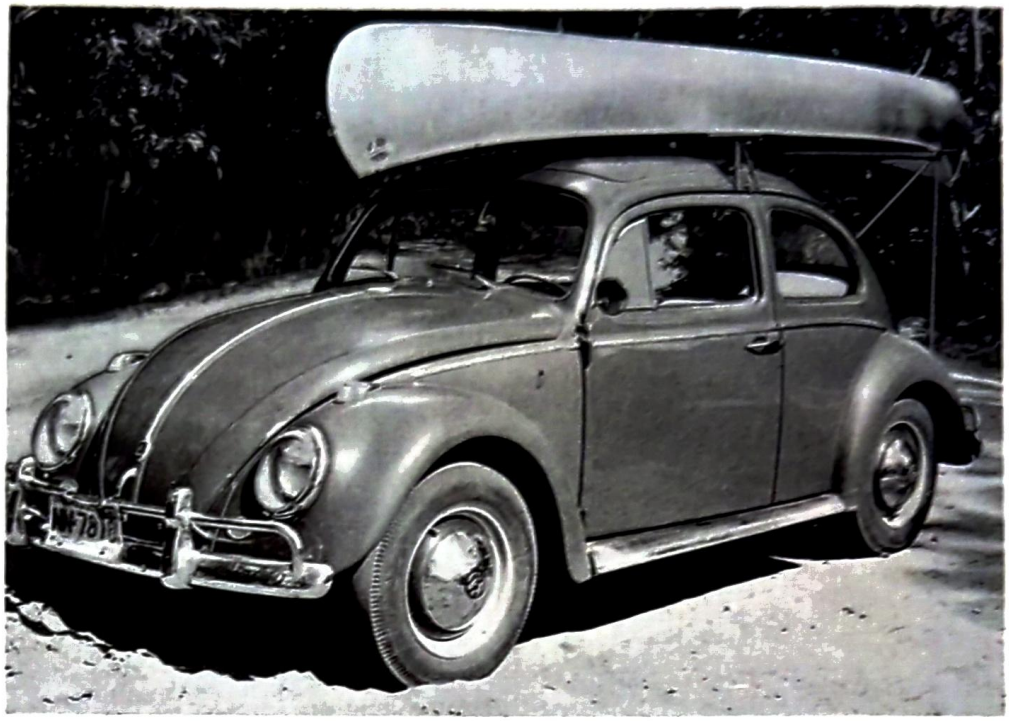


Use the shank end of an old drill as a center punch when mounting a hinge, to produce perfectly aligned holes.



When installing traverse rods, make a simple cardboard template to assure proper alignment of all supports with the windows.

Use precut strips of masking tape to protect panes when painting window sashes and the job will go faster.



VWs can haul bigger loads than many station wagons with this rack you can build yourself

Load carriers for Volkswagens

BY ART YOUNGQUIST and ROBERT HOPPOUGH

Even if you are an efficient packer, you'll welcome the added space these carriers provide

The Top Toter

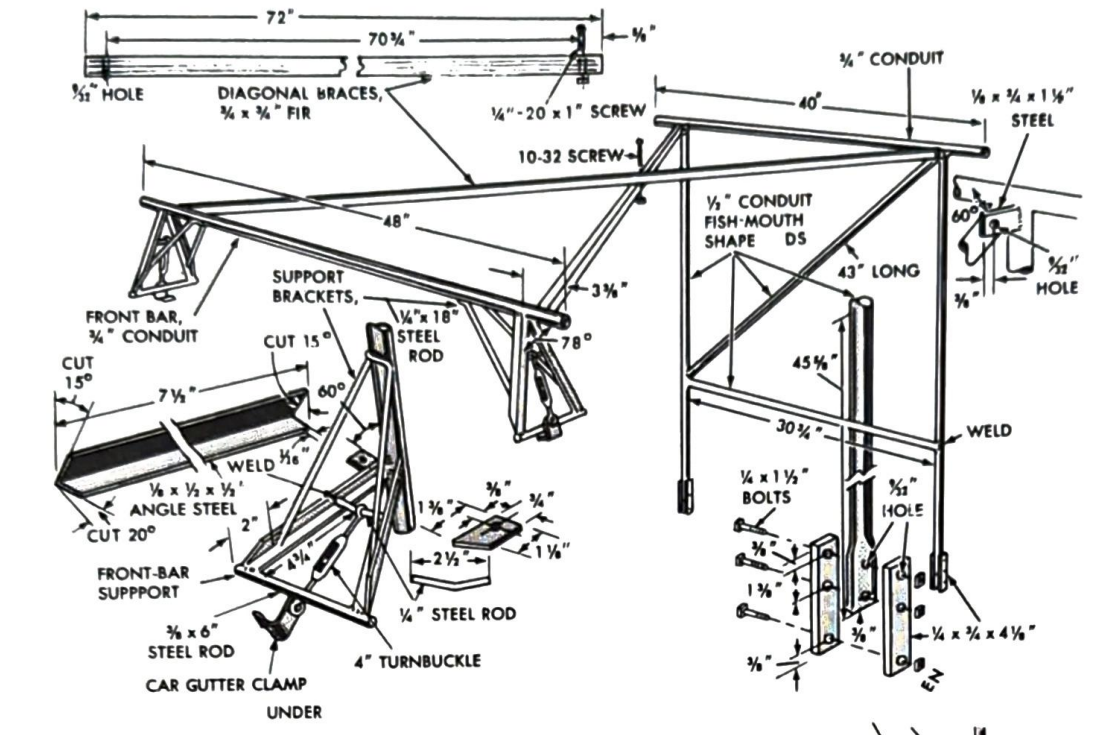
■ THE VERSATILE Volkswagen sometimes needs help. The spare trunk and the conventional top rack will handle luggage and parcels, but have you ever tried hauling lumber or cartopping a boat?

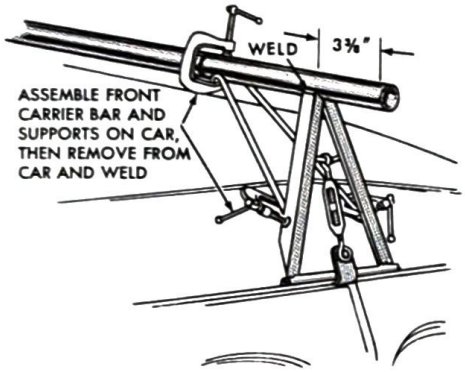
Build this sturdy top toter and you can lash on anything your suspension can stand.

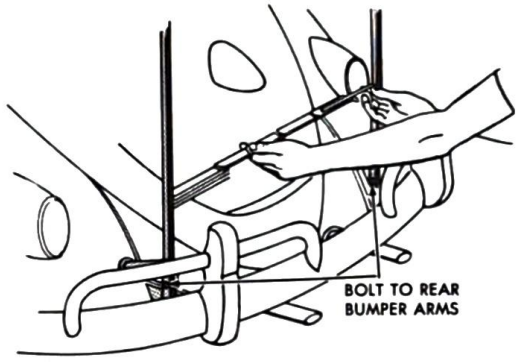
With it, you're a cash-and-carry customer at the lumberyards, and lugging boats or toboggans and skis is a snap. All it costs you is about $5.

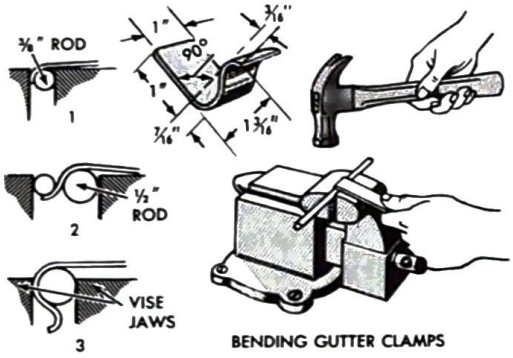
The fact that the rear supports attach to the rear bumper arms means that the car roof bears only half the load. The diagonal braces make an extremely rigid assembly and, because they are only bolted on, permit the carrier to be collapsed for compact storage. Mounting time is only five minutes.

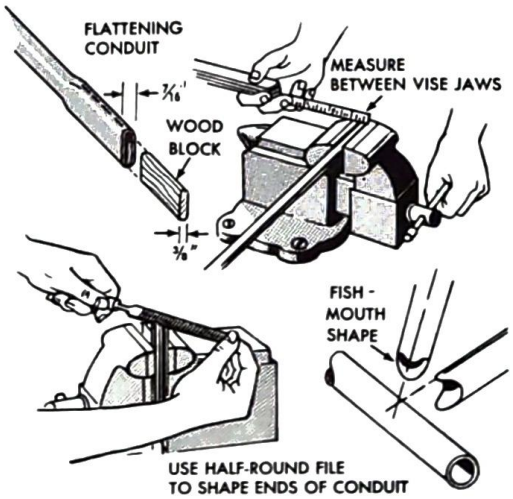
The front roof supports are tackled first. Before welding the ¼ x 2½-in. rods to the angle-iron supports, be sure to slide on the turnbuckles. The gutter clamps are bent as shown and tack-welded to the turnbuckles. You can save yourself this

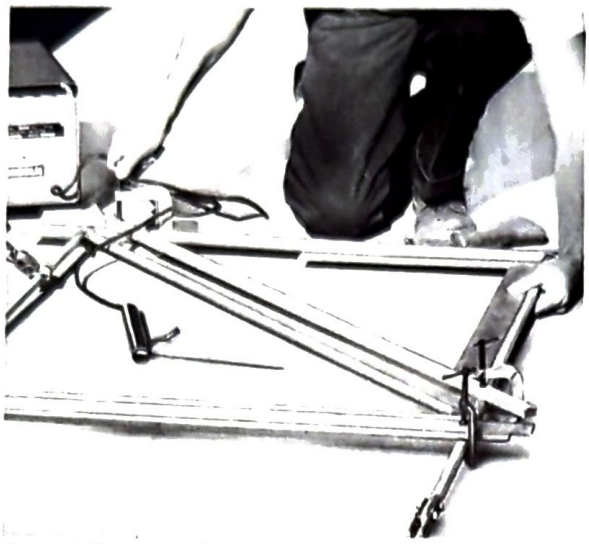

72"
70¾"
⅛"
5/32" HOLE
DIAGONAL BRACES, ¾ x ¾" FIR
¼"-20 x 1" SCREW
¾" CONDUIT
40"
⅛ x ¾ x 1⅛" STEEL
10-32 SCREW
½" CONDUIT FISH-MOUTH SHAPE
43" LONG
60°
5/32" HOLE
⅛"
48"
3⅛"
SUPPORT BRACKETS, ¼"x 18" STEEL ROD
FRONT BAR, ¾" CONDUIT
CUT 15°
78°
CUT 15°
7½"
60°
45⅛"
30¾"
WELD
WELD 1/16"
⅛ x ½ x ½" ANGLE STEEL
CUT 20°
¼ x 1½" BOLTS
5/32" HOLE
⅜"
1⅜"
¾"
1⅛"
2"
4¾"
2½"
FRONT-BAR SUPPPORT
¼" STEEL ROD
⅜ x 6" STEEL ROD
4" TURNBUCKLE
¼ x ¾ x 4⅛"
CAR GUTTER CLAMP UNDER


WELD
3⅜"
ASSEMBLE FRONT CARRIER BAR AND SUPPORTS ON CAR, THEN REMOVE FROM CAR AND WELD


BOLT TO REAR BUMPER ARMS


⅜" ROD
1
1"
3/16"
90°
1"
3/16"
1 3/16"
½" ROD
2
VISE JAWS
3
BENDING GUTTER CLAMPS


FLATTENING CONDUIT
3/16"
WOOD BLOCK
⅜"
MEASURE BETWEEN VISE JAWS
FISH - MOUTH SHAPE
USE HALF-ROUND FILE TO SHAPE ENDS OF CONDUIT



The welding setup for the rear support is assembled on the floor. After the conduit is cut and filed for maximum contact at the joints, the assembly is squared up and clamped with boards before skip-welding

car-top carriers, continued

chore if you can obtain the clamps from a Volkswagen luggage rack. The setup is the same. These ready-mades are padded to protect the car's finish. If you make your own, pad the inside of the clamps and the ⅜ x 6-in. rods on the bottom of the angle-iron supports with plastic rubber, or apply plastic tape.

Assemble the front supports on the car with a 48-in. length of ¾-in. thin-wall conduit and the ¼ x 18-in. rod braces bent to shape against the conduit. Clean off the cadmium plating from the conduit where you will weld. Clamp them together in position and remove from the car for welding. To avoid distorting the conduit, run short skip welds on both sides alternately so one weld can cool before another is laid close to it.

To each rearward angle-iron support, weld at a 60 deg. angle from the horizontal bar the steel tabs to which the top diagonal braces are bolted.

The toter's rear supports are ½ x 45⅝-in. conduit. Partly flatten one end of each in a vise and insert blocks of wood to prevent further flattening. Drill through and bolt on the ¼-in. clamp bars. Bolt the supports around the bumper arms. Then cut conduit to fit between them with fish-mouth-filed ends. Use a coarse half-round file to shape them.

On the floor, assemble the uprights, the ¾ x 40-in. conduit for the top bar, the spreader conduit and a ½ x 43-in. conduit for a diagonal brace. Square up the assembly and clamp with wood braces to hold this form. Tack-weld the setup, try it out on the car for fit and then run fast, small weld beads to avoid burning through the conduit. Again, skip-weld to prevent distortion. Weld on the diagonal-brace tabs at a 60 deg. angle.

The diagonal braces for the top, which bolt onto these tabs, can be made of ¾-in.-square fir or oak, or ½-in. conduit. Use shakeproof nuts or lock washers under all nuts. Paint the entire toter with rust-inhibiting primer and a metal enamel finish coat. Use an epoxy varnish if the diagonal braces are wood.

Once you've finished the carrier, you'll be surprised at the number of uses you'll find for it. Furthermore, it can be installed securely, ready for use, in just five minutes.

Materials List

Quantity	Size, Description	Use
2	½" x 10' thinwall conduits	Rear support
1	¾" x 10' thinwall conduit	Bars
1	⅛ x ½ x ½ x 30" steel angle iron	Front support
1	¼ x 41" steel rod	Front support brace
1	⅜ x 12" steel rod	Front support base
1	1/16 x 1 x 6" steel strip	Gutter clamps
1	¼ x ¾ x 16½" steel bar	Bumper clamps
1	⅛ x ¾ x 6" steel bar	Brace tabs
1	¾ x ¾ 14' fir or oak	Diagonal braces
2	4" closed-length turnbuckles	Front support
4	¼-20 x 1" R.H. machine screws	Diagonal braces
1	19/32 x 2" R.H. machine screw	Diagonal braces
6	¼ x 1½" machine bolts with lock washers, nuts	Bumper clamps

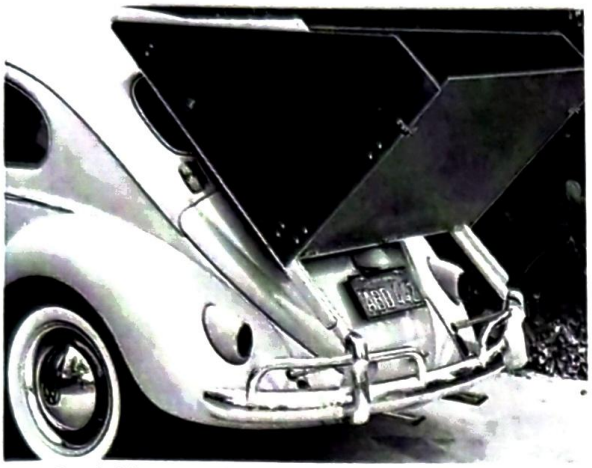
The Piggyback Bin

Another spacemaker for the popular VW, and one which other cars can't boast, is the easily built trash or luggage bin carried piggyback style as shown on the opposite page.

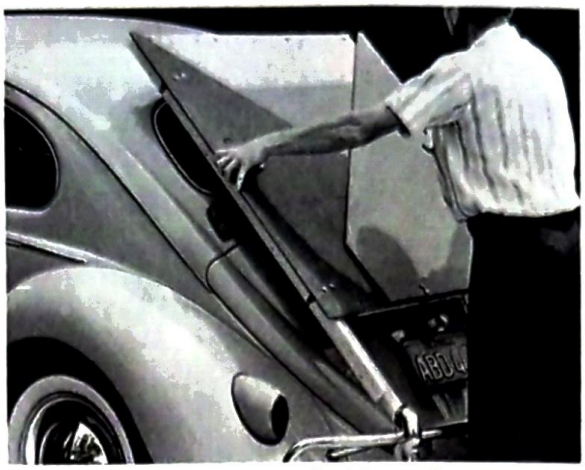
The bin folds for squeeze-in storage and can be put into service in a matter of seconds. Its legs slip into the rear bumper guards; its sides unfold, and you're ready to load up. Its forward center of gravity holds it in place on two suction cups. Only for high-speed driving would hold-down straps be desirable.

Then attach pipe clamps or nail large staples to the upper ends of the legs and run straps from them over the roof to the front bumper.

The frame is 1 x 2 pine or redwood. The rest of the bin can be cut from one 4 x 8-ft. sheet of ¼-in. exterior-grade hardboard or plywood. Place



Piggyback bin, a trash hauler, is the second versatile carrier for space-starved Volkswagens



Folded for compact storage, the bin can be set up in a jiffy after inserting legs in the bumper guards

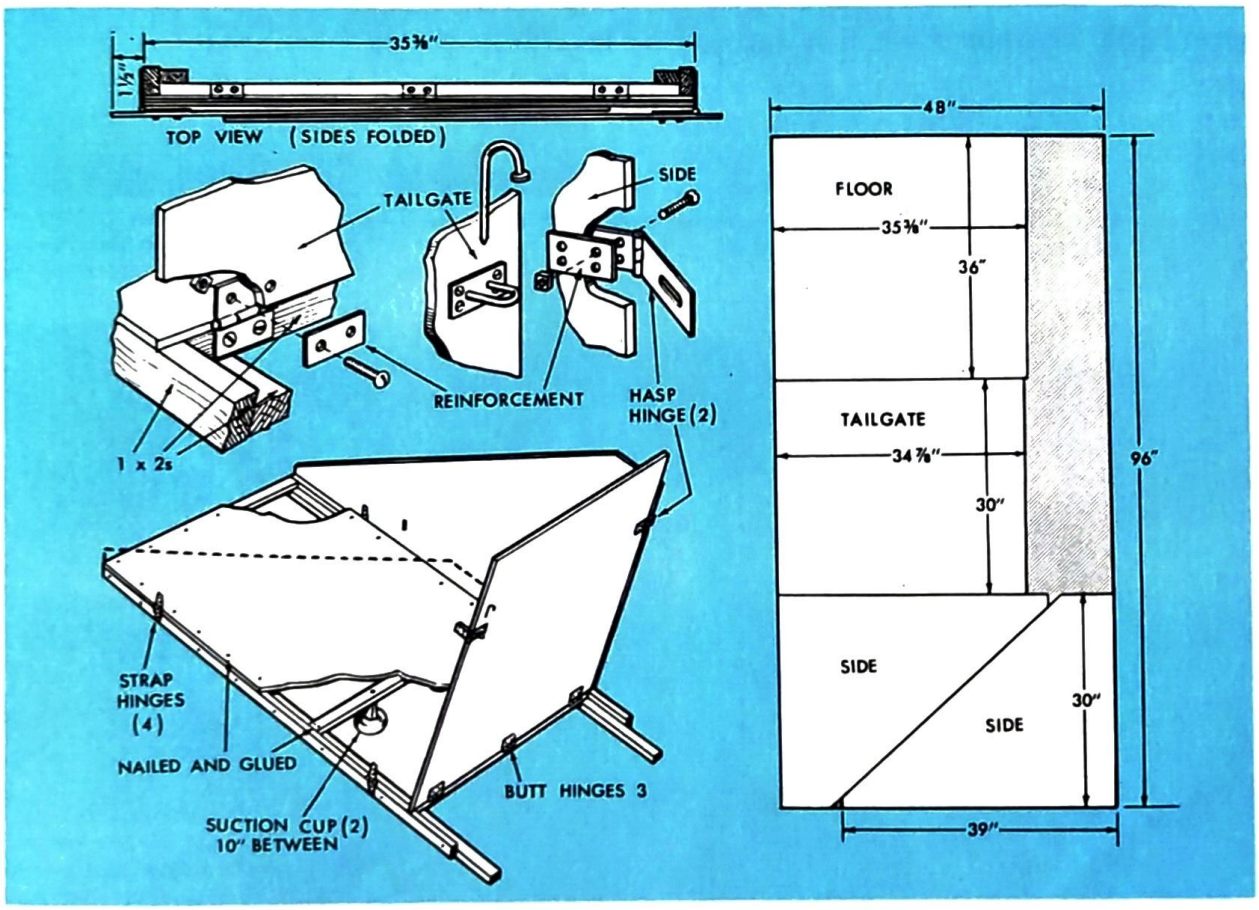
the middle spreader so as to fall at the top of the VW's engine deck to provide a smooth surface for the suction cups.

The tailgate is hinged flush on the butts. The sides are hinged further in, so that their lower edges bear on the frames. As the tailgate folds first, provide clearance slots.

When using the bin, be sure you have a side-view mirror, as the bin covers the rear window.

Materials List

Quantity	Size, Description	Use
2	1 x 2 pine—8′	Frame
1	1 x 2 pine—10′	Frame
1 sheet	¼″ x 4 x 8′ exterior-grade Hardboard or plywood	Sides, floor
3	Plated 2″ butt hinges	Tailgate
2 pr.	2″ strap hinges	Sides
1 pr.	Plated hasp hinges	Latch
5 doz.	½″ F.H. machine screws	Hinges, latch
½ pt.	Plastic resin glue	
	Assorted nails	



Upper berth for a station wagon

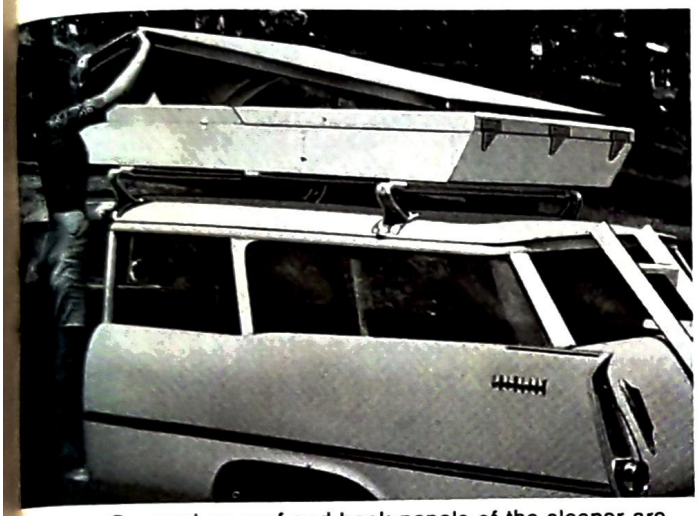
BY M. D. SHIRLEY

This "upper berth" converts any station wagon into a luxurious five-bed motel on wheels, within minutes

■ WITH THE KIDS bedded down in the wagon and mom and dad tucked in "upstairs" on a soft inner-spring mattress, the "rugged outdoor life" becomes a treat even a city softie can appreciate. With no tent to set up, no bunking on the ground, no crawling things to worry about—you're as snug as a bug in a rug, rain or shine.

Four screen-covered circular windows let you enjoy cool, insect-free breezes on a sweltering night, and quick-fit window shutters keep you cozy and dry during a storm. A removable pull-man-type ladder, which hooks over the wagon roof gutter, stows in the space between car top and sleeper while you travel.

Folded, the unit resembles a flat-bottom boat only a foot high, and because of its streamlined hull shape, you'll hardly know it's up there while you're sailing down the highway. No tarp is needed to cover it since interlapping, tape-sealed joints make the sleeper watertight.



Propped-up roof and back panels of the sleeper are locked together at an angle on each side with wooden brackets tightened inside with two wing nuts

The roof and the back are raised as a single unit and the front wall is swung up to support it. A single bolt through both sections holds them securely

Erecting the sleeper is kids' play—just thirteen wing nuts and you're in business. First the two screen-door hooks on each side (which tie the roof down) are unhooked. Next the hinged filler strips on each side are swung outward. The two-part top is raised at the center hinge and propped up on each side with 13-in. lengths of 1 x 2 which are carried separately for the purpose. These props hold the two sections at the angle required for inserting the bolts of wooden tie plates in registering holes in the roof sections. Wing nuts on the inside hold the tie plates. The hinged top is now raised as a single unit and the front (door) wall is swung up so a bolt may be inserted through its top frame member and the forward flange of the roof, and secured with a fifth wing nut. Finally, the sidewalls are swung up and fastened to the side flanges with four more wing nuts on each side, making the thirteen. In the folded position, the hinged sidewalls lay one on top of the other, flat on the 48-in. mattress, the hinged front wall rests on the sidewalls and the hinged top fits down over the whole thing like the cover on a box.

study the drawings

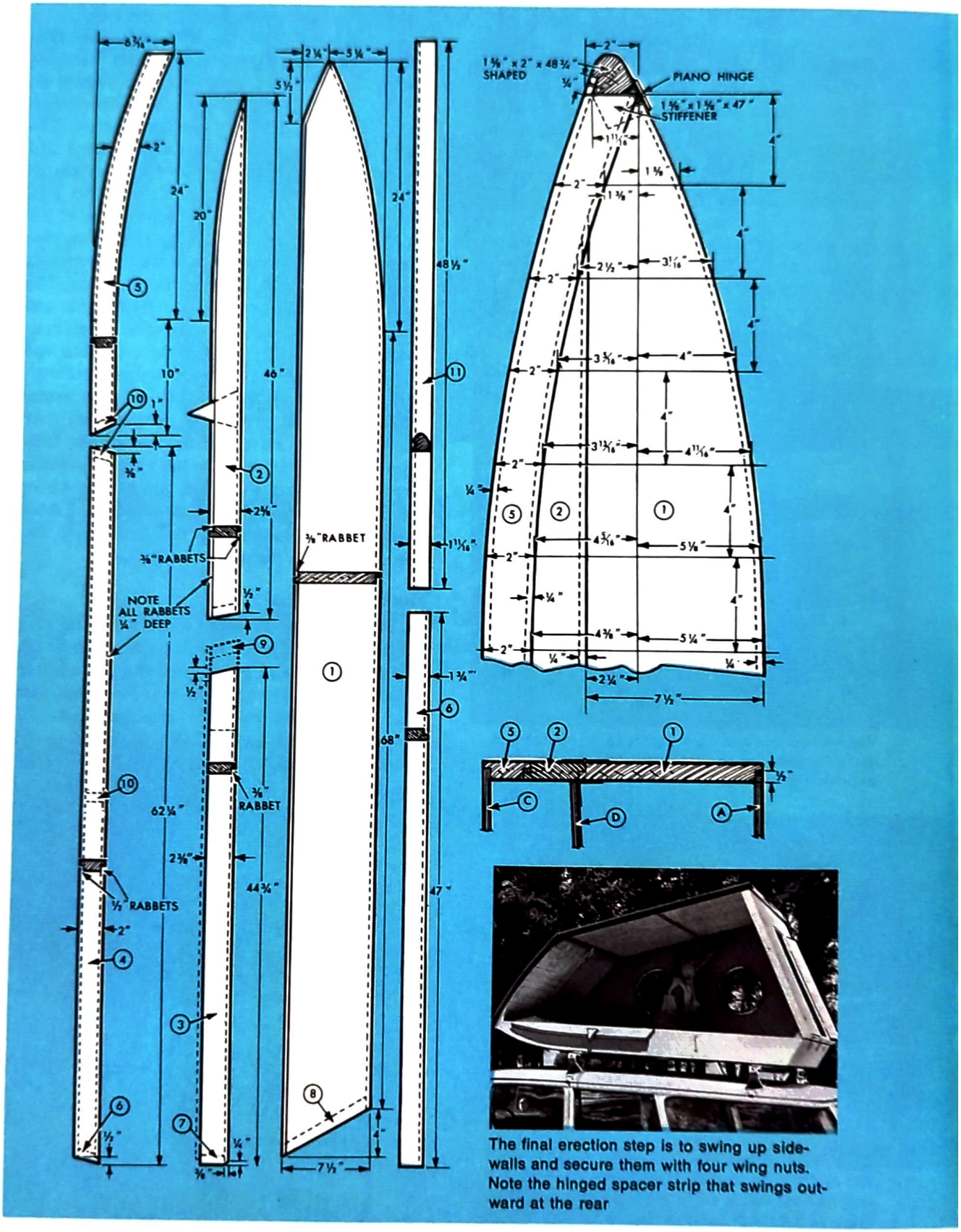
First study the drawings to get a general idea of how the parts hinge and fit together. Begin by laying out full-size patterns of the curved rear ends of parts (1), (2) and (5). Note that part (2) rabbets into part (5) and that part (1) rabbets into parts (2) and (5), so that the solid lines of the pattern are not always the cutting lines. Both top and bottom edges of these six pieces—as well as parts (4)—must be rabbeted. Trace your pattern on ¾-in. pine or fir, positioning it to producing right- and left-hand members, and saw out. All rabbets are cut ¼-in. deep (the plywood thickness) but vary in width.

Cut the rear-edge stiffener next from 1⅝-in.-sq. (2 x 2) stock, 47 in. long, and install between the ends of parts (1) with two #10 1¾-in. F.H. wood screws. This member also takes the screws for the piano hinge that joins the top and floor sections, later on.

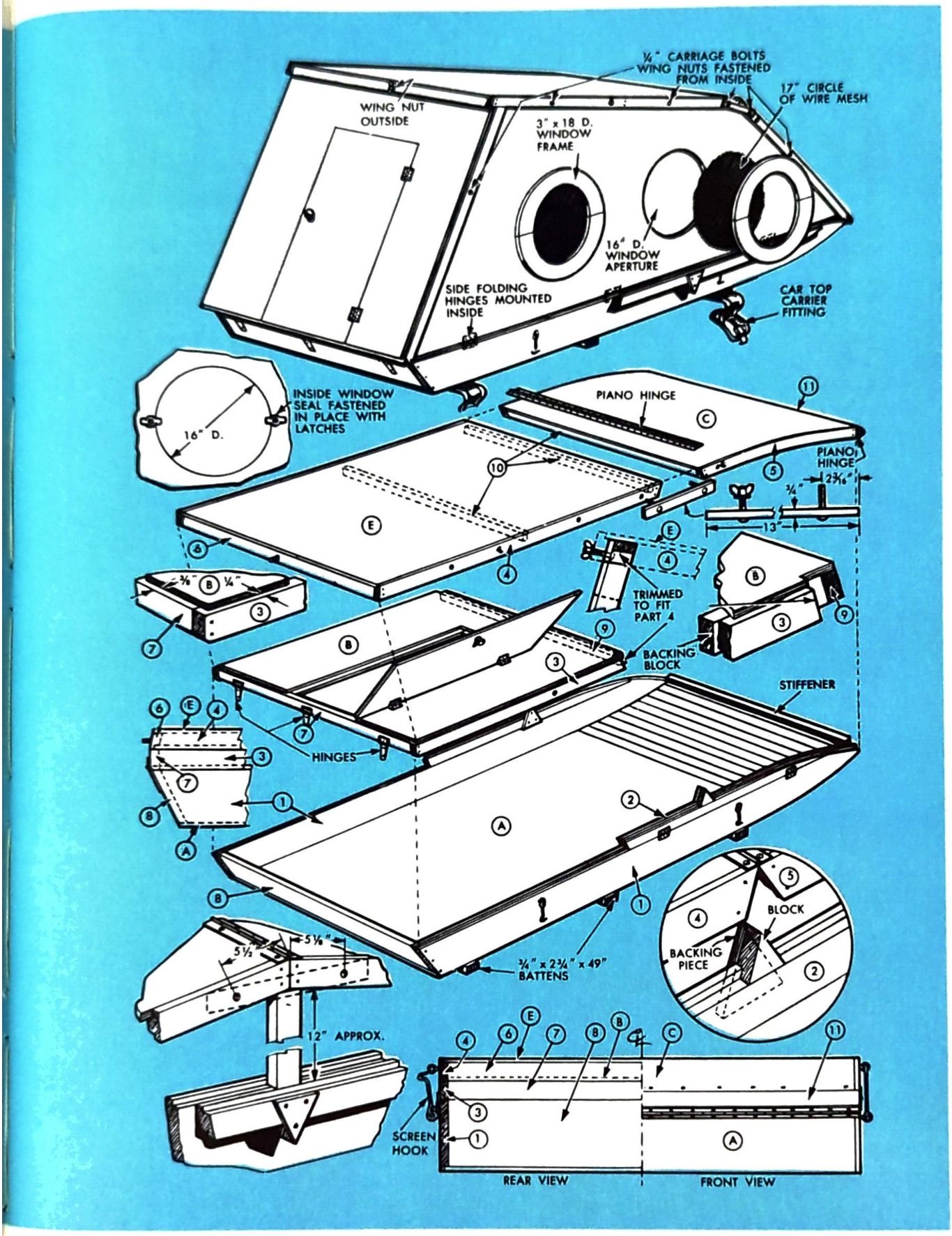
Cut part (8) from ¾-in. pine and install between parts (1) with three #10 1¾-in. F.H. screws at each side. Note that the top and bottom edges of this piece must first be beveled.

Ten saw kerfs 1/16 in. deep and 2 in. apart are made across the rear end of panel (A) on the inside to facilitate bending the plywood around

upper berth, continued



The final erection step is to swing up sidewalls and secure them with four wing nuts. Note the hinged spacer strip that swings outward at the rear


¼" CARRIAGE BOLTS WING NUTS FASTENED FROM INSIDE
17" CIRCLE OF WIRE MESH
WING NUT OUTSIDE
3" x 18 D. WINDOW FRAME
16" D. WINDOW APERTURE
SIDE FOLDING HINGES MOUNTED INSIDE
CAR TOP CARRIER FITTING
INSIDE WINDOW SEAL FASTENED IN PLACE WITH LATCHES
16" D.
PIANO HINGE
PIANO HINGE
2 3/16"
¾"
13"
TRIMMED TO FIT PART 4
BACKING BLOCK
STIFFENER
HINGES
BLOCK
BACKING PIECE
¾" x 2¾" x 49" BATTENS
5½"
5⅛"
12" APPROX.
SCREEN HOOK
REAR VIEW
FRONT VIEW

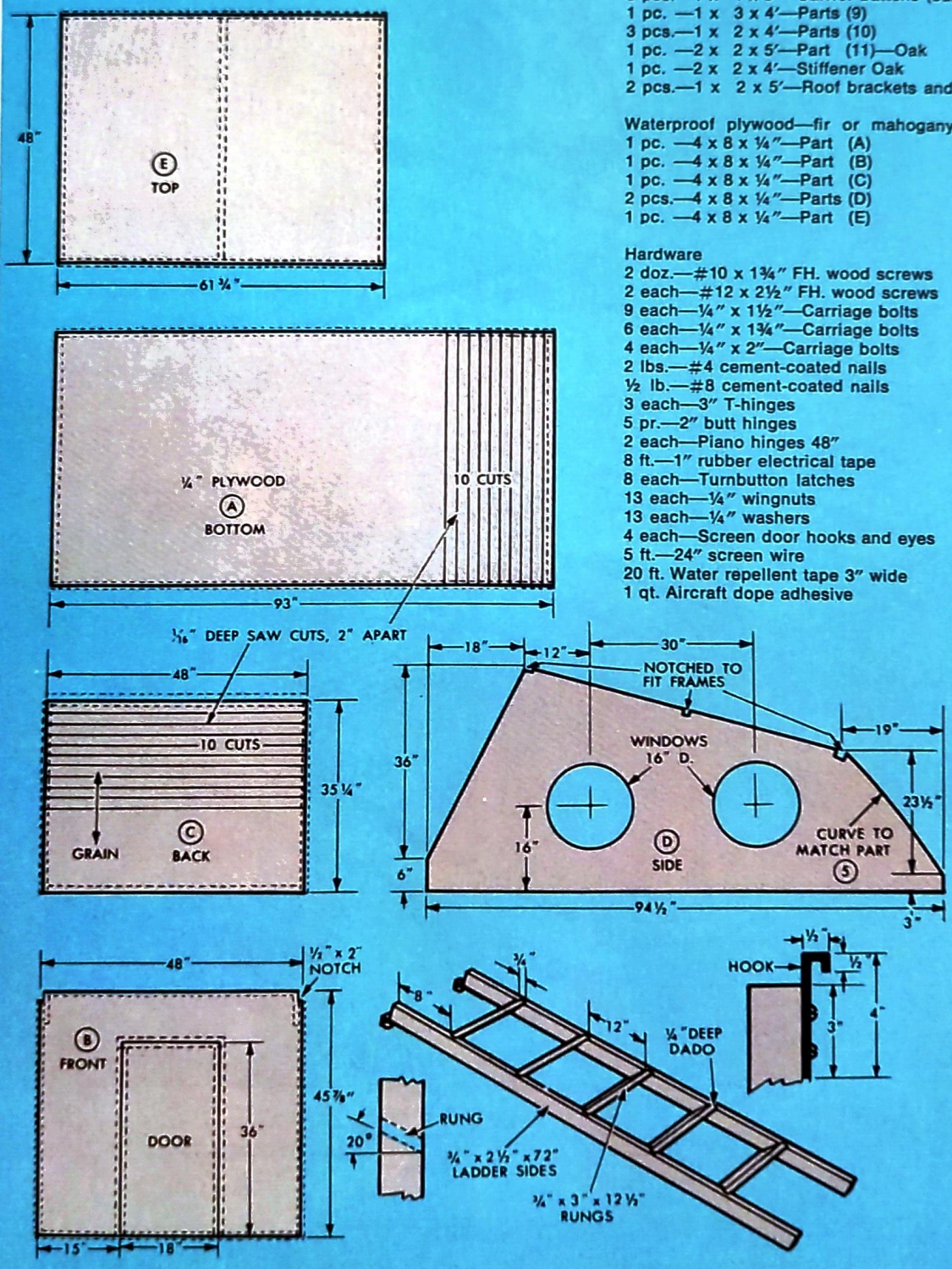
upper berth, continued

BILL OF MATERIALS

Lumber—pine or fir
2 pcs.—1 x 8 x 8′—Parts (1)
2 pcs.—1 x 4 x 4′—Parts (2)
2 pcs.—1 x 3 x 4′—Parts (3)
2 pcs.—1 x 4 x 6′—Parts (4)
2 pcs.—1 x 6 x 3′—Parts (5)
1 pc. —1 x 2 x 4′—Part (6)
1 pc. —1 x 3 x 4′—Part (7)
1 pc. —1 x 10 x 4′—Part (8)
3 pcs.—1 x 4 x 5′—Carrier battens (oak)
1 pc. —1 x 3 x 4′—Parts (9)
3 pcs.—1 x 2 x 4′—Parts (10)
1 pc. —2 x 2 x 5′—Part (11)—Oak
1 pc. —2 x 2 x 4′—Stiffener Oak
2 pcs.—1 x 2 x 5′—Roof brackets and props

Waterproof plywood—fir or mahogany
1 pc. —4 x 8 x ¼″—Part (A)
1 pc. —4 x 8 x ¼″—Part (B)
1 pc. —4 x 8 x ¼″—Part (C)
2 pcs.—4 x 8 x ¼″—Parts (D)
1 pc. —4 x 8 x ¼″—Part (E)

Hardware
2 doz.—#10 x 1¾″ FH. wood screws
2 each—#12 x 2½″ FH. wood screws
9 each—¼″ x 1½″—Carriage bolts
6 each—¼″ x 1¾″—Carriage bolts
4 each—¼″ x 2″—Carriage bolts
2 lbs.—#4 cement-coated nails
½ lb.—#8 cement-coated nails
3 each—3″ T-hinges
5 pr.—2″ butt hinges
2 each—Piano hinges 48″
8 ft.—1″ rubber electrical tape
8 each—Turnbutton latches
13 each—¼″ wingnuts
13 each—¼″ washers
4 each—Screen door hooks and eyes
5 ft.—24″ screen wire
20 ft. Water repellent tape 3″ wide
1 qt. Aircraft dope adhesive



the curved end of parts (1). Turn the assembly upside down and nail the rear edge of panel (A) to the 1⅝-in. stiffener across the front, using #4 cement-coated nails spaced 1 in. apart. Now dampen the inside surface of the plywood by placing hot wet towels over the saw kerfs and gradually nail the panel in the rabbets and across part (8), spacing the nails now 2 in. apart. Trim off the panel flush with part (8).

Now cut three oak carrier battens ¾ x 2¾ x 48½ in. and attach each to the bottom edges of parts (1) with two #10 1¾-in. F.H. wood screws. Place one 30 in. from the back end and the other two 28 in. on centers. Three ¼-in. holes are drilled through the bottom plywood and the battens for ¼ x 1¾-in. carriage bolts to bolt the sleeper to the car-top carrier brackets.

cut out parts

Make up the front wall and door by first cutting parts (3), (7) and (9) from ¾-in. stock. Note that part (7) is only 2 in. wide whereas parts (3) are 2⅜ in.; that parts (3) are chamfered at the lower corners to assume the same angle as parts (1); and that, unlike the other side members, parts (3) are rabbeted along the lower edge only. Nail parts (3) to the ends of part (7) with #8 cc nails, then add plywood panel (B) after cutting it 45⅞ in. long and sawing out the 18 x 36-in. door. Use No. 4 cc nails for this, spacing them 2 in. apart. Note that the panel is recessed from the outer faces of parts (3) and (7) to form rabbets. Part (9) across the top of the front wall, measures ¾ x 2⅜ x 47 in. and has beveled top and bottom edges. This sets flush with the edge of the panel—not recessed like the other framing members. It fits between the ½ x 2-in. notches at the upper corners. To bridge the gap between parts (3) and (9), a backing block is nailed to them both, as shown in the details. Frame the door opening with 1 x 2s extending ½ in. into the opening to form a stop for the hinged panel.

Attach the hinged spacers next—parts (2)—securing each with 2-in. butt hinges mounted on the outside. The sole function of these parts is to fill the space behind parts (3) and make the sleeper watertight when folded. Note here that the triangular blocks which fill the gaps that open between folded parts (4) and (5), are backed up on the inside with triangular pieces cut from scrap plywood.

Now the top assembly: Form the nose piece—part (11)—from 1⅝ x 2-in. pine to match your full-size section. Note that it has a ¼ x ¾-in. rabbet cut across the top. Place parts (5) in position on the assembly and drive a No. 12 2½-in. F.H. wood screw through part (11) at each end, and into the end grain of parts (5).

Now cut part (10) ¾ x 1½ x 47 in., bevel the top and bottom edges as required and nail between the front ends of parts (5). Again make saw kerfs on the inside of panel (C), dampen with wet towels as before and nail to part (11) first, then to the rabbets of parts (5). Follow by adding a 48-in.-long piano hinge to the front edge and make it waterproof with a strip of rubber electrical tape between hinge and plywood.

assemble forward panel

Assembly of the forward top panel presents no problems, except that the top and bottom edges of part (6) and one of the parts (10) must be beveled before they're nailed between parts (4); in addition, part (6) must have a ¼ x ½ in. rabbet cut in its beveled bottom edge. The center brace (another 10) needs no bevels.

Now hinge the back wall and top together, placing rubber tape under the hinge leaf as before. Holes for the tie-plate carriage bolts are made through parts (4) and (5) on each side of the hinged joint. Finally, this top-and-back assembly is joined to the bottom assembly with a piano hinge across the joint between the stiffener and nose piece—part (11).

The two sidewalls, parts (D), are cut according to the pattern. The cutouts from the circular windows are saved and used as bad-weather shutters, secured with turnbuttons. Aluminum or plastic mesh is tacked over the windows and the tacked edges are covered with overlapping circular trim pieces. The sidewalls are hinged to the inside faces of parts (1), mounting three pairs of butt hinges just below the top edges. The spacing of the three notches in the top edges of the sidewalls, which must be made to clear the roof crossmembers, is determined from the assembly itself, after hinging.

In order to make the sleeper completely watertight, glue a strip of water-repellent cloth tape (3 in. wide) along the hinged joints of parts (D) and (1) on the inside. With parts (B), (E) and (C) raised and (D) collapsed, glue tape also at the forward corners between (1) and (5), and at the aft corners between (1) and (3) on each side. The tape at the corners fills voids which are necessary to permit (D) to fold.

See also: cabanas; camping; car-top carriers; pick-up campers; shelters, camping; sleeping bags; tents; trailers.

Seven variations on a basic cart

By ALFRED W. LEES

Presenting a wonderful host-with-the-most hot cart for entertaining—and six variations on the basic design to cover all your needs

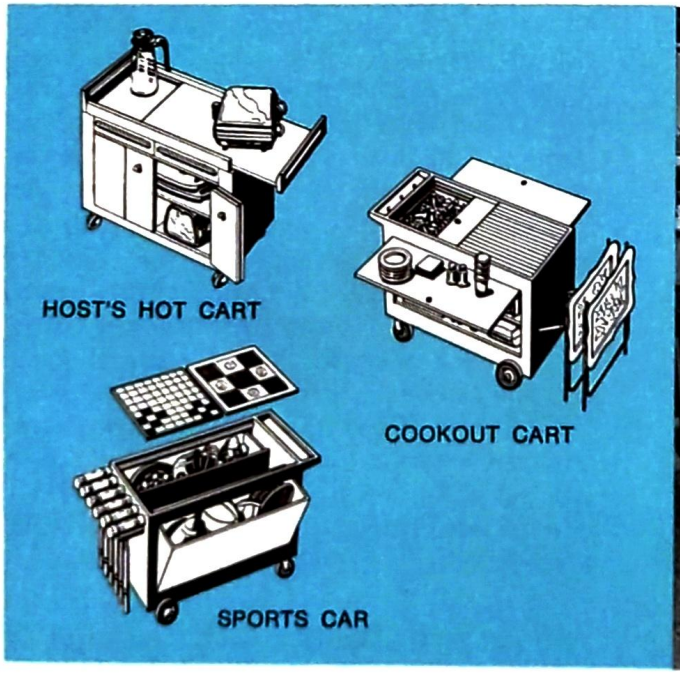
YOU WON'T HAVE TO wear a lampshade to be the hit of your next party. All you have to do is wait for the right moment and then roll out your host cart. Does that sound too easy? Well, the admiring ooohs and whistles from your guests when they see it will prove it. And the whistles are your cue to remark in an offhand fashion, "Oh, I made it last week."

During the next half hour, after you whip out the extension cord, plug it in to a wall outlet, and then casually serve your guests *a la carte,* the conversation will be exclusively on your handiwork. The men will want to know how you did it, and the ladies will be trying to find a way of motivating their husbands into performing the same miracle.

This cart was designed for show-off impact as well as practicality. It was put together to be the hottest host-helper on wheels, and yet to cost as little as possible. And it was put together because there is no cart on the market as handsome or as useful—giving the do-it-yourselfer a rare opportunity to produce a unit that money can't buy. As a bonus, there are seven variations to the basic cart plans.

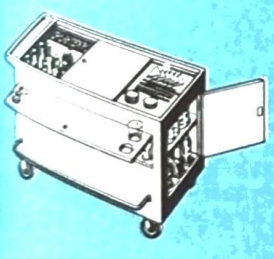
Here are some of the features of the host cart:

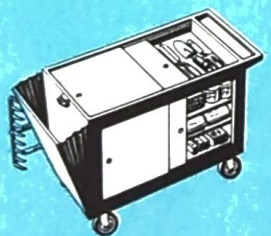
- A recessed hot tray to keep hot hors d'oeuvres warm, that lets you take the chill off of serving plates in best-restaurant fashion, and features a "hot spot" with a temperature high enough to



The cart not only provides limitless convenience for serving at parties, but also doubles as a very handy breakfast cart in the kitchen

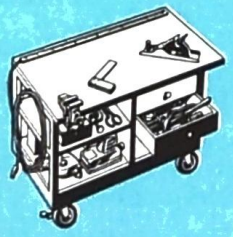
BAR CAR

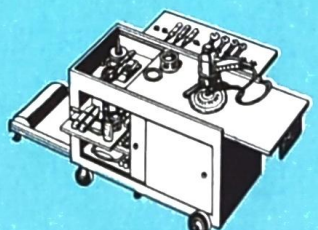




POTTING BENCH

ROLLING SHOP



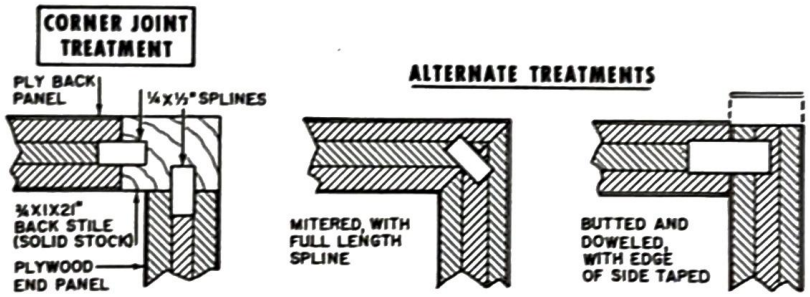


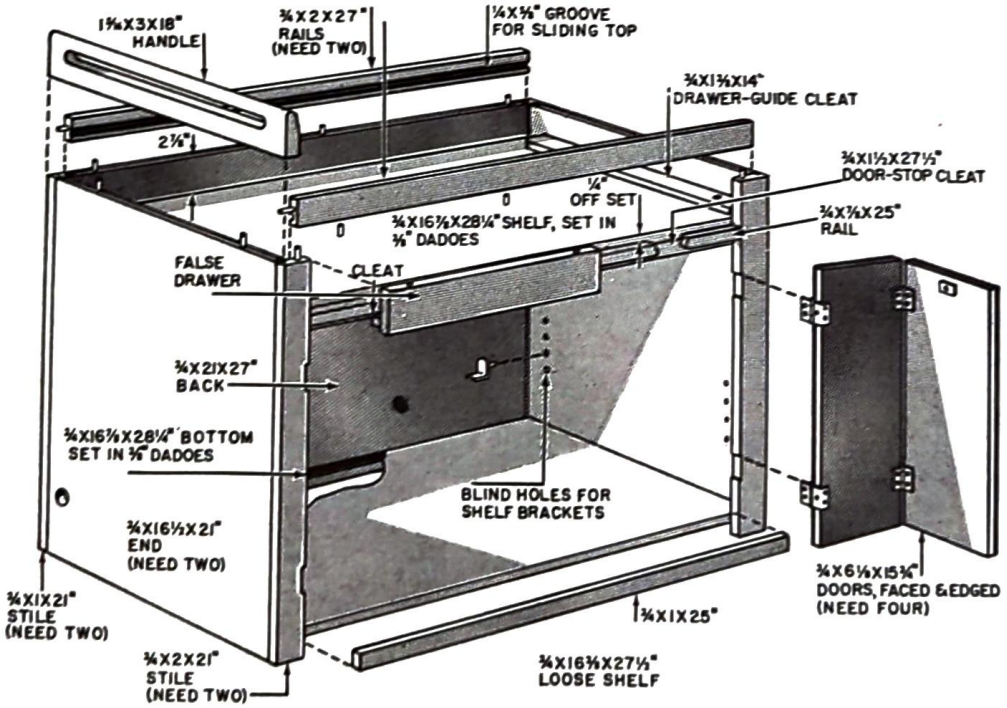
SATURDAY MECHANIC'S CART

seven cart variations, continued

keep a pot steaming—ending the embarrassment of serving lukewarm coffee. The hot tray is tucked beneath a sliding plastic-faced top that provides full serving space even when the hot tray is in use.

- A 15-ft. extension cord to permit you to wheel the cart to the heart of the party. This cord retracts automatically on a hidden reel, and also provides current for other outlets which let you use your other appliances (electric carving knives, broilers, grilles, wafflers)—which, incidentally, you can store on the cart behind the bi-





fold doors. The best part of this electrical set-up is that it requires no fancy wire splicing; you just plug the "built-in" units together.

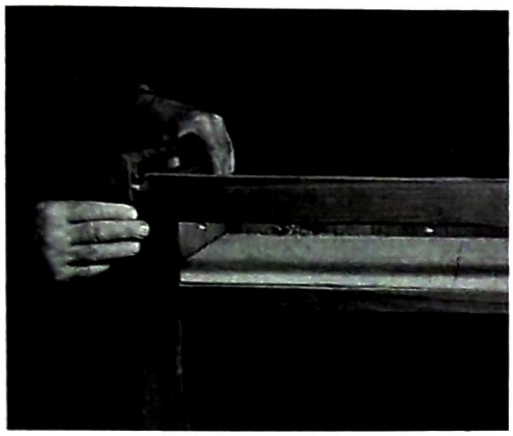
- Two of the four ball casters have step-on locks that anchor the cart and convert it into a sturdy buffet island for "come-and-get-it" service.

The designer of this cart specified walnut-veneered plywood for the side and back rails and solid stock walnut stiles and rails, and has joined these so that no laminated edge is exposed; veneer finishing tape is required only on the front edge of the adjustable shelf.

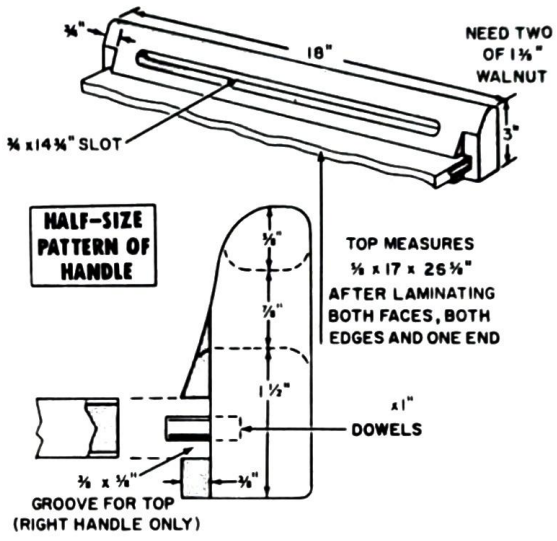
Because the cart is intended to be a fine piece of furniture, it is built like one—with splining and doweling and mitering in professional fashion. If you prefer, you can simplify the joint treatment as suggested in the alternate drawings provided—or simplify it even more if you choose.

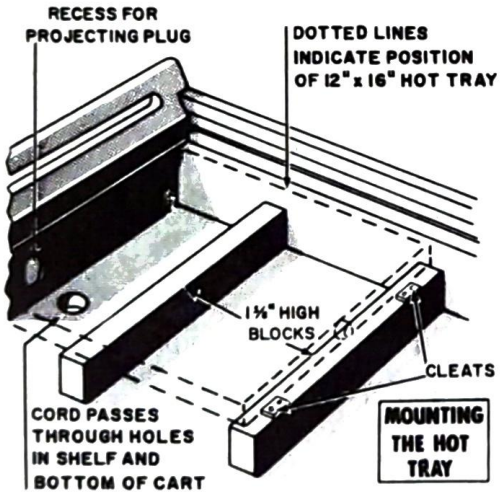
However you simplify the joints, keep in mind that the handles must be sturdily attached. If you do dowel the stationary one to the front and back rails, you'll find it easier to glue up these parts and join them, as a unit, to the assembled chassis. And if you decide to dowel the rails to the back panel and front stiles, be sure to locate these dowels so they won't block the ¼ x ⅝-in. grooves for the sliding top.

The top, too, can be simplified. The overall dimensions given in the handle-detail sketch are for a ½-in. plywoood panel *after* a plastic lam-



The stationary handle is doweled to both rails. They are set in to bring the handle flush with the end and are in turn doweled to stiles

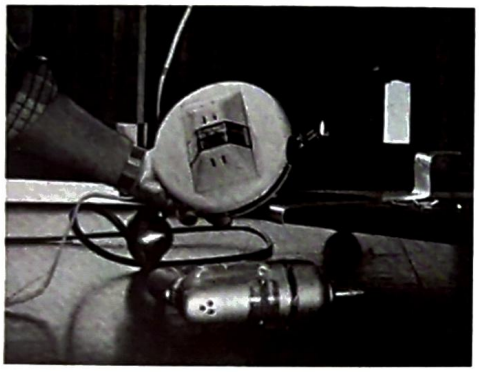



RECESS FOR PROJECTING PLUG
DOTTED LINES INDICATE POSITION OF 12" x 16" HOT TRAY
1⅛" HIGH BLOCKS
CLEATS
CORD PASSES THROUGH HOLES IN SHELF AND BOTTOM OF CART
MOUNTING THE HOT TRAY

The tray stays loose for easy removal and is kept from sliding by a press fit against tiny cleats. A utensil drawer is under the tray

This double-exposure dramatizes how the cart's cord retracts until plug nests inside

seven cart variations, continued

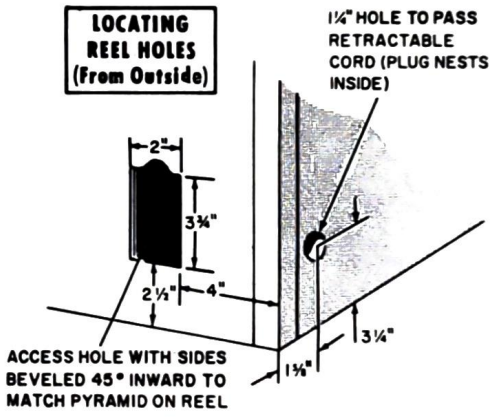


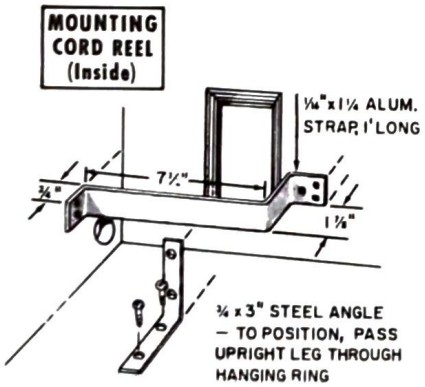
Two access holes, one for the cord and the other for the outlet pyramid, must be accurately located

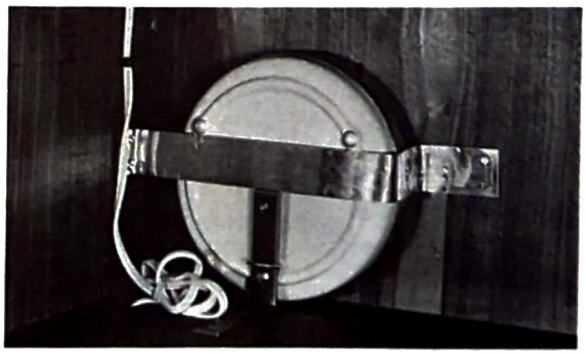
inate has been applied to all faces and edges except the end that's doweled into the movable handle's groove. This was designed this way to avoid all possibility of warp, to dress up the edges that show when the hot tray is in use, and to provide slick movement of the top inside its grooves.

You could get by with laminate on the top surface only, using a chipboard panel to prevent warp, and simply sand and wax the long edges. You'd then need to adjust the size of the panel and width of the grooves for a snug sliding fit.

The original cart was made with a pumpkin-colored top which contrasts nicely with the gray-green laminate selected for the door panels. The dimensions given for these panels are *before* any laminate is applied. If you cement strips of plastic to both long edges (as well as the top), you'll actually want to cut each panel slightly narrower




MOUNTING CORD REEL (Inside)
¼"x1¼ ALUM. STRAP, 1' LONG
7½"
¾"
1½"
¼ x 3" STEEL ANGLE — TO POSITION, PASS UPRIGHT LEG THROUGH HANGING RING



Hold the reel flat against the panel before marking for lead holes through the strap and angle leaf

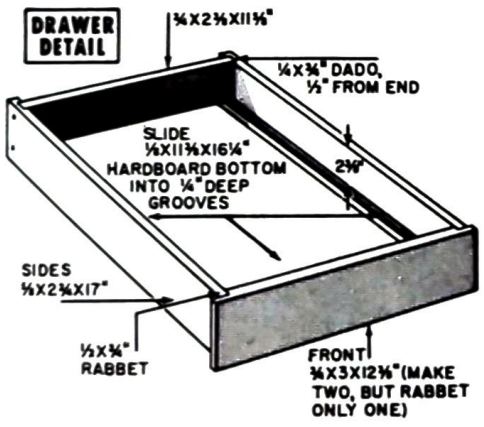
than 6⅛ in. to allow for clearance. Both leaves of the offset hinges are set into the stiles, and the doors are held shut by a pair of magnetic catches —one on each central panel. The bifold arrangement gives easier access to the storage space than two sliding panels would provide, and to avoid the wide swing two hinged panels would require; the latter might prove awkward when the cart is wheeled close to a dining table to serve as a sideboard. The alternating colors also add to the design, but to simplify construction, try another door treatment.

The "sculptured" handles also add a lot of style. You make the slot by drilling ¾-in. holes at each end and cutting out the waste between them with two passes of a jig, sabre or keyhole saw. The taper is a simple bevel cut made on the bench saw with the slotted handle blank held upside-down and snug against the fence. This bevel is then "concaved" with a half-round rasp or coarse file, before softening corners with a flat rasp and sandpaper.

The false drawer is a panel the same size as the actual drawer front, and is held in place with two dowels up into the rail plus a cleat tacked to the top "shelf" and glued to the back of the panel. The trim rail beneath the drawers covers the joint line between the top "shelf" and the doorstop cleat to which the magnet sections of the catches are screwed. This trim rail creates a rabbet that serves as a stop for the drawer front.

Note that both the top "shelf" and the bottom panel are glued into dadoes cut into the back and end panels. The upper groove is 2⅞ in. from the top, the lower one ¼ in. from the bottom of these panels.

The handsomest finish for walnut is, happily, also the simplest: you just rub in boiled linseed oil or Danish oil finish with a saturated cloth and wipe off the excess with a dry, lint-free cloth.



The mounting of the accessories is shown in the details. Since the cord reel's outlet cluster is in the shape of a flattop pyramid, when you cut the hole that lets this pass through the back panel you hold the saw at a 45-deg. angle. With the face of the reel pressed firmly against the inside of the panel, this beveled hole nests the pyramid snugly and lets all three outlets protrude far enough outside to take an appliance plug. The arched top edge of the hole is optional, to provide access for a large, round plug. The plug on the end of the hot-tray cord is merely passed through holes in the top "shelf" and bottom panels and brought around for insertion in the lowest outlet of the pyramid. The dimensions for locating these holes, as given on page 536, will position the retracted plug inside the 1¼-in. hole so that the plug's prongs can just be gripped with the fingers. Black enamel applied to the edges of the holes gives a neater effect.

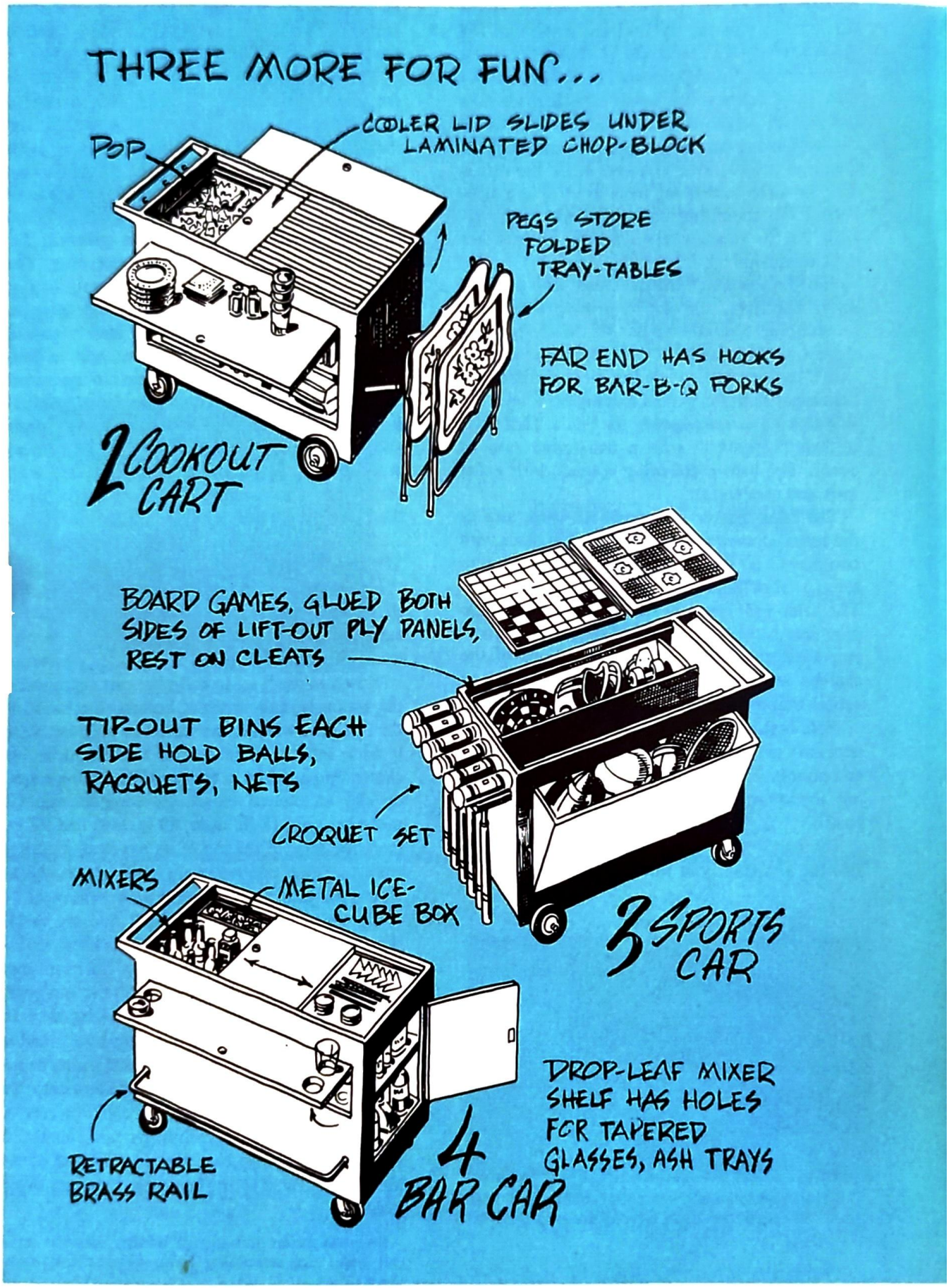
now install casters

Before placing the hot tray on its blocks, flip the chassis over onto its handles and fasten a caster at each corner. Use a scrap of ¼-in. plywood beneath each plate, for greater clearance.

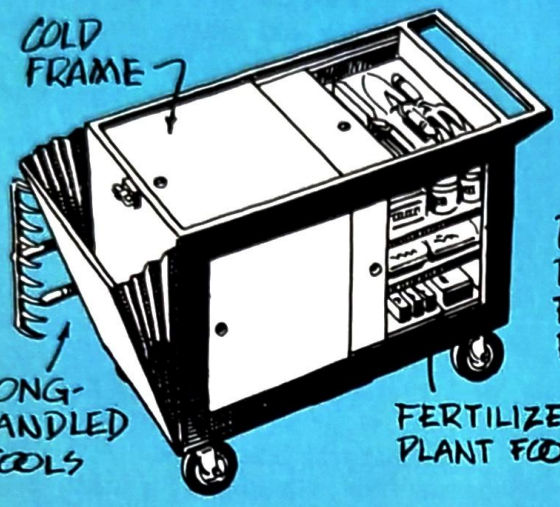
Now you're all set to roll your cart right where the action is, and watch it become the focus of the fun. And when it has served its purpose, snug it back into its berth—in a kitchen niche, as shown on page 534, a corner of the dining room, or into an unused closet. Its compact size (it measures only 18 in. wide, 29 in. long and 27 in. from the floor to the top of its handles) makes it easy to store unobtrusively until it's ready to wow your next party or serve your next meal.

On the next two pages, you'll find six variations of the host cart just described. These variations will cover just about any situation that could arise in your home. If you're a gardener, there's a potting bench; there's a rolling shop to serve as an auxiliary to your workbench and a mechanic's cart to double your handy-man capabilities. In the entertainment department, we present an immensely practical cookout cart, a bar cart for liquid refreshments, and finally, a very unusual sports cart for carrying just about all the games and sports equipment you are likely to own.

See also: garden caddy; high fidelity, portable; patio cart; plant cart; remodeling ideas; wheelbarrow; workshops.


THREE MORE FOR FUN...
POP
COOLER LID SLIDES UNDER LAMINATED CHOP-BLOCK
PEGS STORE FOLDED TRAY-TABLES
FAR END HAS HOOKS FOR BAR-B-Q FORKS
2 COOKOUT CART
BOARD GAMES, GLUED BOTH SIDES OF LIFT-OUT PLY PANELS, REST ON CLEATS
TIP-OUT BINS EACH SIDE HOLD BALLS, RACQUETS, NETS
CROQUET SET
3 SPORTS CAR
MIXERS
METAL ICE-CUBE BOX
DROP-LEAF MIXER SHELF HAS HOLES FOR TAPERED GLASSES, ASH TRAYS
RETRACTABLE BRASS RAIL
4 BAR CAR

. . . PLUS THREE TO EASE OUTDOOR JOBS

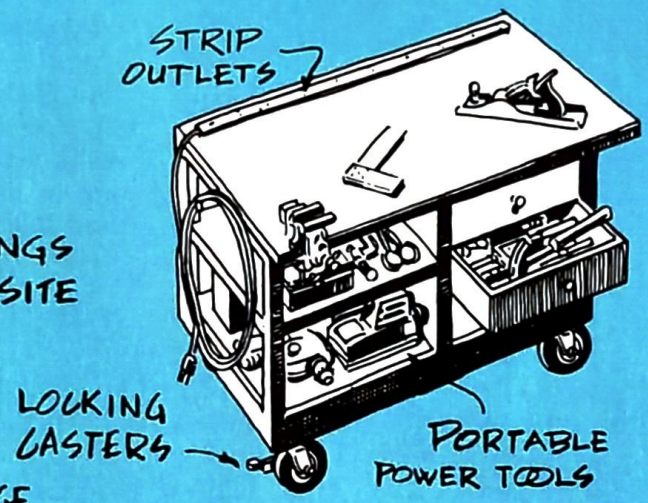


5 POTTING BENCH

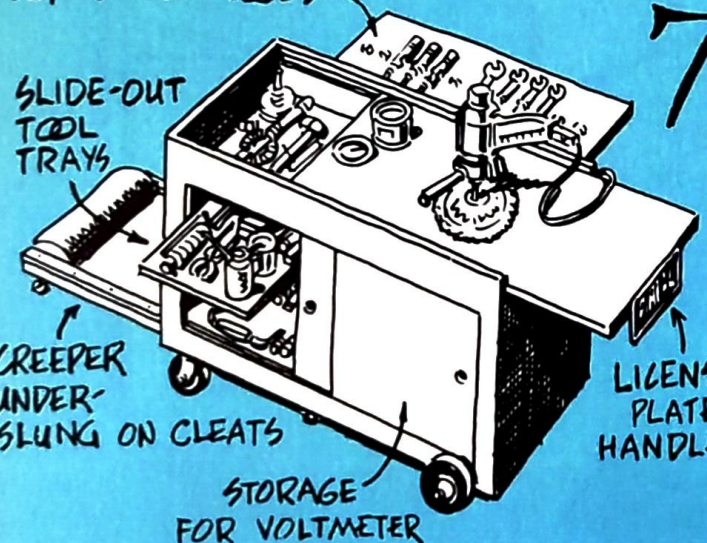
PLEATED-CANVAS POCKET ON FRONT FOLDS OUT FOR PRUNED TWIGS

6 ROLLING SHOP

LONG CORD BRINGS POWER TO JOB SITE



7 SATURDAY MECHANIC'S CART



SLIDING TOP IS LIKE HOT TRAY'S, BUT EXPOSES STORAGE WELL FOR TOOLS & OWNER'S MANUAL

Party cart

BY DAVE SWARTWOUT

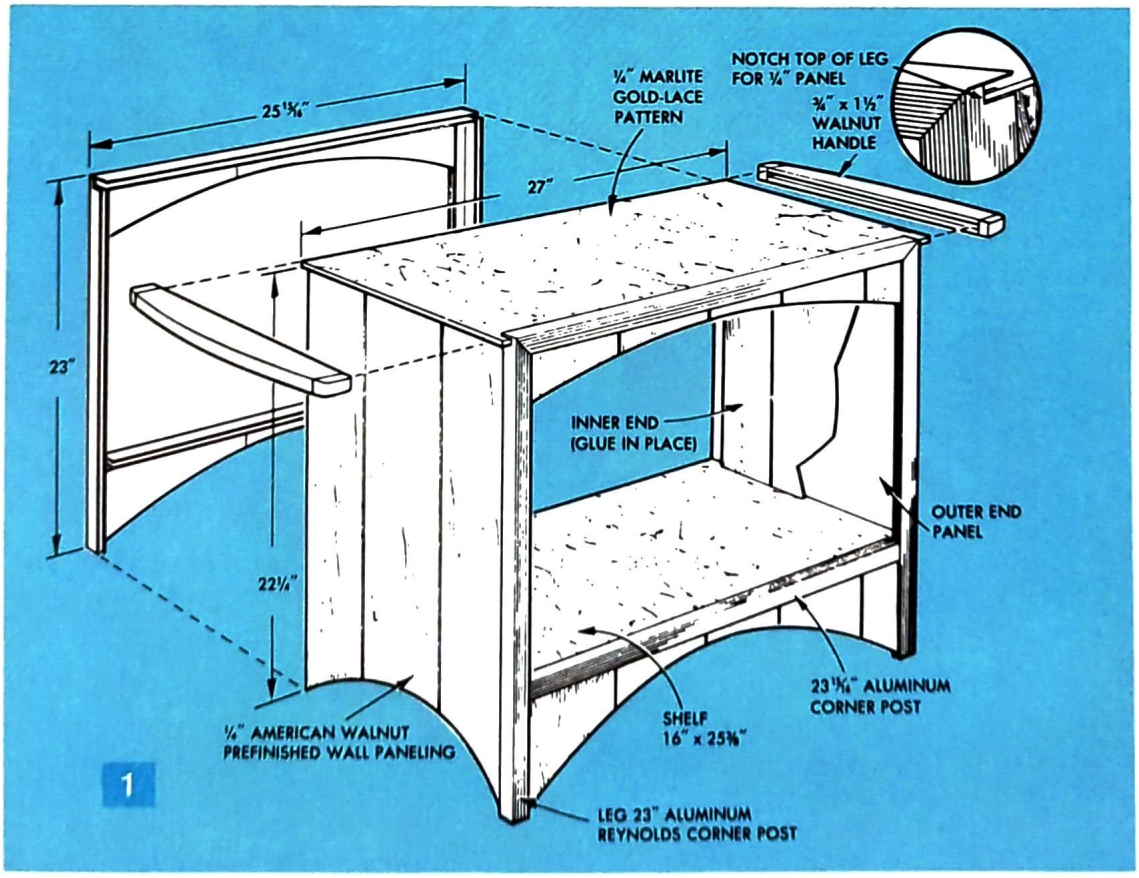
You'll find scores of uses for this attractive cart made of prefinished materials

■ WITH THE EXCEPTION of its walnut handles, there is no finish to apply to this smart hostess cart once you get it put together—it's made of materials which are already finished.

While the cart you see here was made of random plank and marble-pattern hardboard, aluminum corner posts and 3-in. ball casters, you can choose any prefinished hardboard and casters you wish.

The first step is to study the general pull-apart drawing in Fig. 1. Then lay out full-size paper patterns for the side brackets, following Fig. 2. You'll notice that each bracket is made in two pieces which are glued and butted end to end during assembly. The brackets and the inner and outer ends of the original cart were cut from walnut-finish hardboard, and Fig. 5 shows how you can get all of the parts out of a single 16 x 96-in. panel. The top and shelf of the cart were cut from a marbleized pattern. Keep in mind that the cart top will overhang ½ in. at each end to provide for attaching the handles.

All of the cutting should, of course, be done with a fine-toothed blade. If you are working with a jigsaw, where the cutting action takes place on the down stroke, the panel should be sawed face up to avoid roughing up the visible

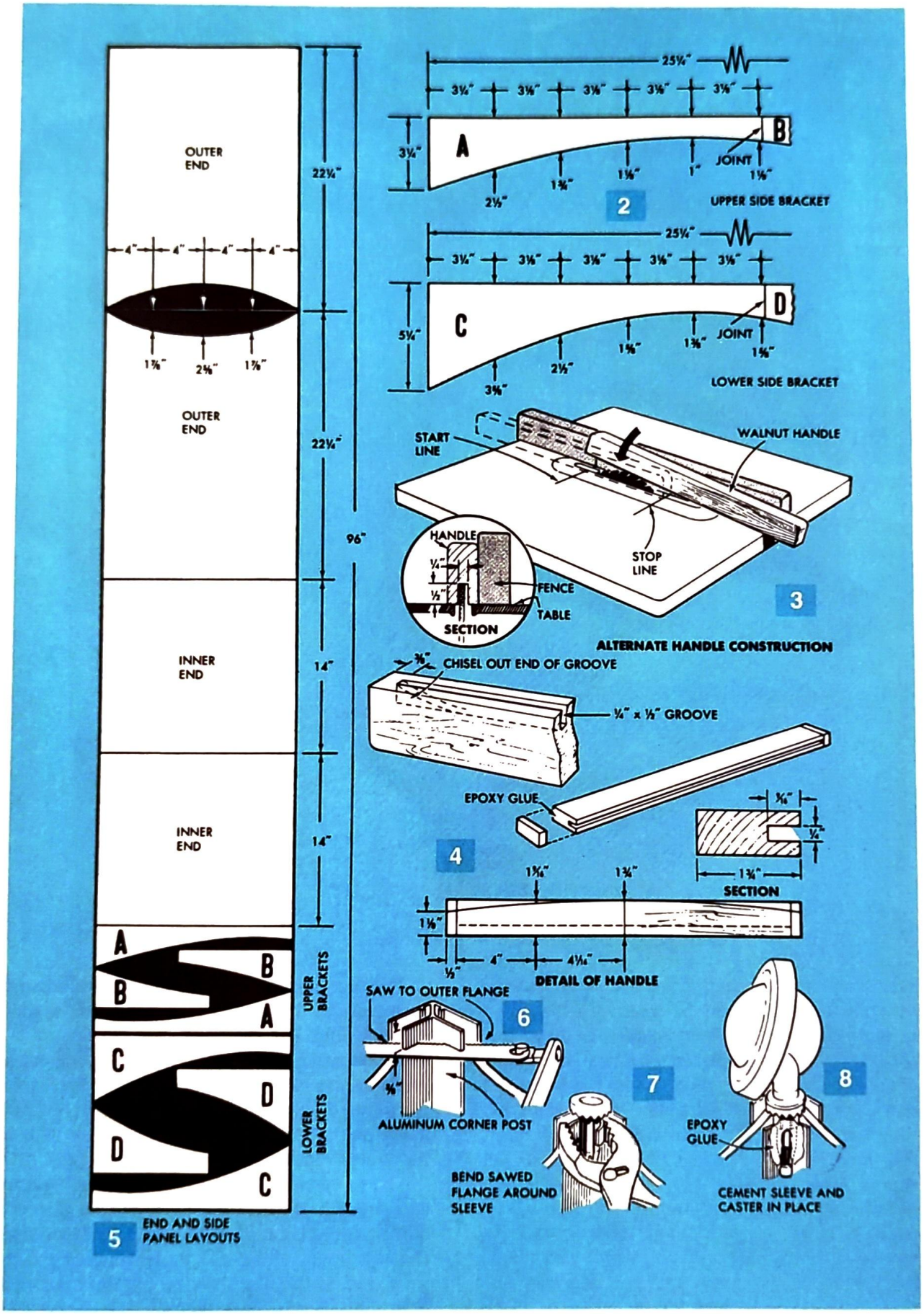


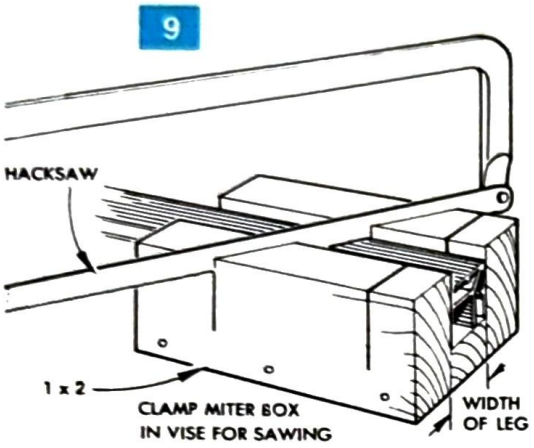
side. On the other hand, if you are using a saber saw, the pattern should be traced on the back of the panel which is then turned face down for the cut. As a precaution, test your saw on a piece of scrap panel and, if working with the face side down, guard against scratching the surface of the slick finish. If the blade is fine enough, you may find that you can saw right on the line. A coarser blade will have to be guided about 1/16 in. outside the cutting line, then a file and sandpaper, or a spokeshave, can be used to work to the finish line. Since random-plank hardboard has tongue-and-groove edges, it is necessary to plane the edge to remove the tongue.

The aluminum corner posts can be mitered accurately by hand with a hacksaw and a simple miter box as in Fig. 9.

If you prefer, a cut-off wheel mounted on a radial arm or table saw may be used. Don't forget to wear goggles to protect your eyes from flying particles if you are doing the job with a power saw and abrasive wheel.

Just to be on the safe side, it's a good idea to test-assemble the cart without glue to make certain that all of the parts fit properly. Then take the cart apart, apply epoxy cement along each joint, and reassemble. For the strongest possible joints, it's best to use the type of epoxy that


OUTER END
22¼"
4" 4" 4" 4"
1⅞" 2⅛" 1⅞"
OUTER END
22¼"
96"
INNER END
14"
INNER END
14"
A B B A
C D D C
UPPER BRACKETS
LOWER BRACKETS
5 END AND SIDE PANEL LAYOUTS
25¼"
3¼" 3¼" 3¼" 3¼" 3¼"
3¼"
A
B
JOINT
1⅛"
1⅜"
1⅜"
1"
2½"
2 UPPER SIDE BRACKET
25¼"
3¼" 3¼" 3¼" 3¼" 3¼"
5¼"
C
D
JOINT
1⅛"
1⅜"
1⅜"
2½"
3⅜"
LOWER SIDE BRACKET
START LINE
WALNUT HANDLE
STOP LINE
HANDLE
¼"
½"
FENCE
TABLE
SECTION
3 ALTERNATE HANDLE CONSTRUCTION
⅜"
CHISEL OUT END OF GROOVE
¼" x ½" GROOVE
EPOXY GLUE
4
⅜"
¼"
1¾"
SECTION
1⅝"
1¾"
1⅛"
½"
4"
4⅛"
DETAIL OF HANDLE
SAW TO OUTER FLANGE
6
⅜"
ALUMINUM CORNER POST
7
BEND SAWED FLANGE AROUND SLEEVE
8
EPOXY GLUE
CEMENT SLEEVE AND CASTER IN PLACE



Before gluing, it is best to test-assemble all parts to make sure that everything fits. Disassemble, apply the glue, and reassemble

comes in two tubes, the contents of which are combined just before use. When you are applying the epoxy, keep in mind that it will stain the face of the panels. Don't let excess epoxy run down the surface.

how to cut the legs

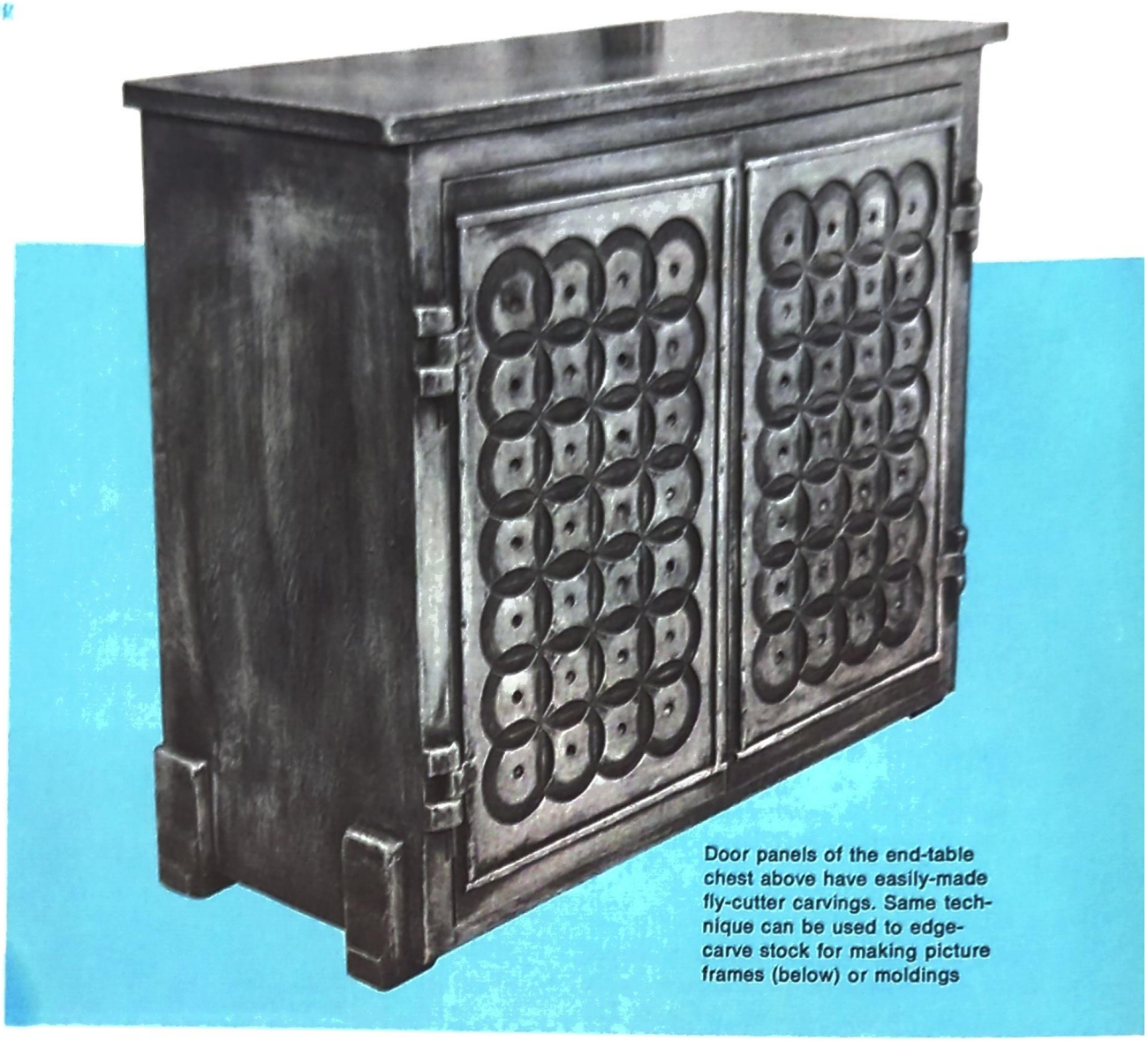
After the epoxy has set, the cart can be turned face down on the floor so that the inner flange of each leg may be cut as shown in Fig. 6. The cut should be made as deep as possible, using the outer flange as a stop. Then, as Fig. 7 indicates, the sawed flange is bent around the caster sleeve with a pair of pliers. After inserting the casters into the sleeves, cement the sleeves with epoxy to the ends of each corner post as in Fig. 8. Enough epoxy should be used to surround the socket and provide a permanent bond.

The solid-walnut handles are made on the table saw, using a dado head or repeated passes with an ordinary blade.

Two ways of making the handle are shown in Figs. 3 and 4. The first method illustrated is to cut a blind dado, that is, start the cut by lowering the stock onto the turning blade, then stop the pass before the blade cuts through the end nearest you. To be sure that the cut does not go too far, make pencil marks on the saw table to line up with the ends of the stock. After cutting the dado, finish with a chisel. The other way is to run the groove full length and cap the ends with walnut. In either case, you'll find the result attractive.

Epoxy cement applied to the dado secures the handles to the top. Finish them first with linseed oil

There's no need for the cart to stand idle when you are not entertaining. It is sturdy enough to support a sewing machine



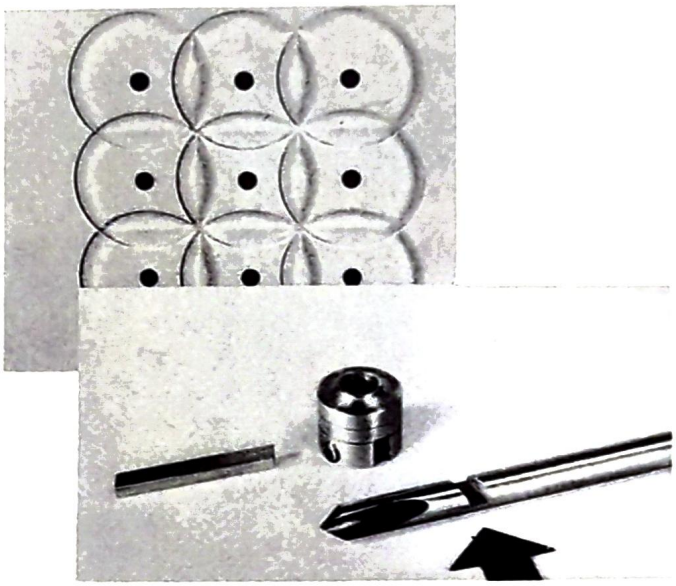
Door panels of the end-table chest above have easily-made fly-cutter carvings. Same technique can be used to edge-carve stock for making picture frames (below) or moldings

Decorative carving with a circle cutter

By R. J. DeCRISTOFORO

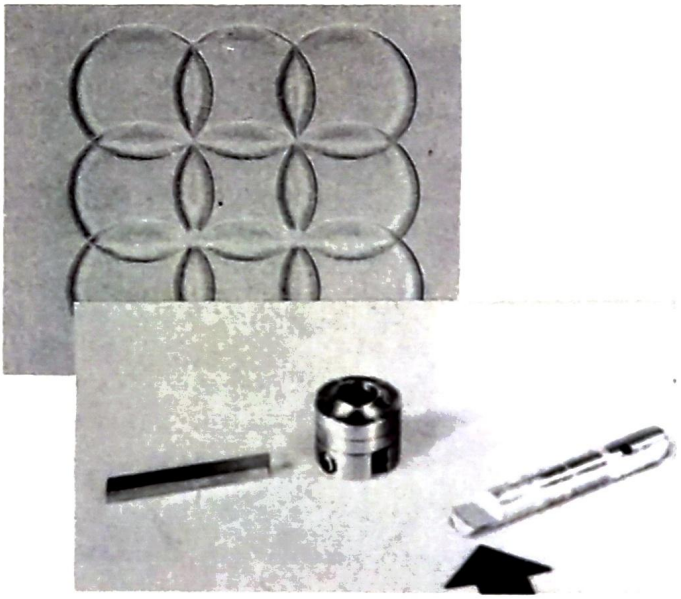
Easy to make items become attractive with this smart technique that anyone can learn to use successfully

This technique can make a simple box into an attractive container. Photos below show important differences in technique. Arrow (center photo) points to slanted groove in pilot drill in which machine-bit cutter seats. Set-screw bears down on cutter and drill. To eliminate center hole (below) substitute a piece of drill rod, rabbeted, for the pilot drill



Want holes? Use the pilot drill

If not, replace pilot with drill rod



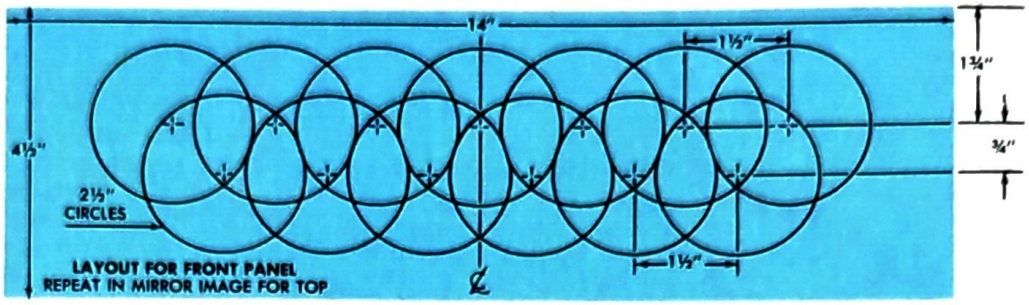
■ CIRCLE CUTTERS are usually used to make holes that are too large to bore with ordinary drills and bits. But the type shown here (often called a fly cutter) can also be used to create intricate geometric carvings.

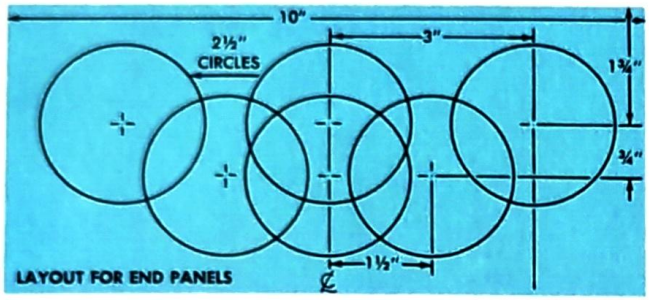
This drill-press accessory differs from the conventional circle cutter in that it employs a horizontal shaft; such types do not make the bevel cut required for the carved effect pictured here.

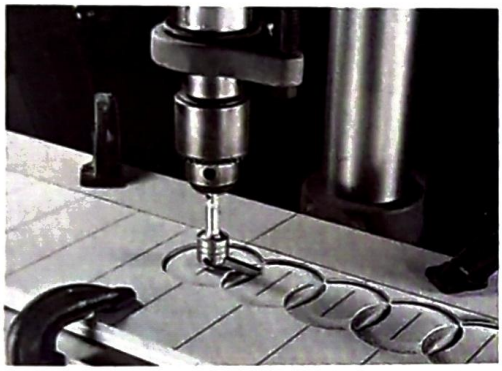
All cutters have a pilot drill that passes through the hub to anchor the cutter's spindle at the center of the circle. In normal use, the hole left by this drill is in the waste stock that falls away when the bit bites through the work. In fly-cutter carving, however, you don't cut *through* the stock, so the pilot hole will remain. This can be a pleasing accent in large designs—such as the cabinet doors shown on the opposite page. If you prefer nonperforated panels, you can plug these center holes with dowels of contrasting wood. Or you can avoid the hole altogether by replacing the pilot with a stub of drill rod that won't penetrate the carved surface. You just file one end of the rod to produce a rabbet set in the same angle as the machine-bit groove in the pilot drill.

When using the pilot drill, the layout for the carving pattern is simplified. Merely draw intersecting lines on the work, spacing them for the desired overlap of whatever size circle you've adjusted the bit to cut. Then drop the tip of the drill onto each intersection.

Actual layouts of the sides of the chess box are detailed here as an example. Without the pilot, the problem of positioning these circles accurately is solved by clamping the fence or guide to the drill-press table. The fence provides uni-

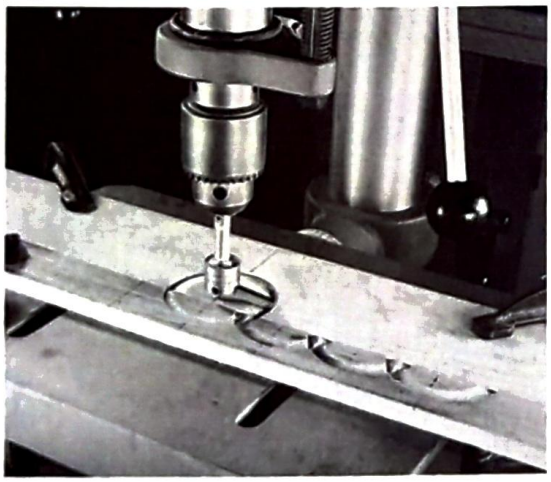






You needn't draw circles in laying out work —just mark center lines for uniform spacing. Line up with guide mark on clamped fence

Center-line system works, too, when work receives only part of cut, as for picture molding shown on page 544. Wide fence moves work to side



form edge-distance, and a line scribed across it to indicate the spindle center can be lined up with the pattern marks on the work. It's a good idea to clamp the work securely before each cut.

Work at a low speed, feeding the cutter slowly into the work. Use a depth-stop to control depth of cut and a back-up block to minimize break-through damage, if you're using the pilot drill. Test each new pattern on scrap to avoid spoilage.

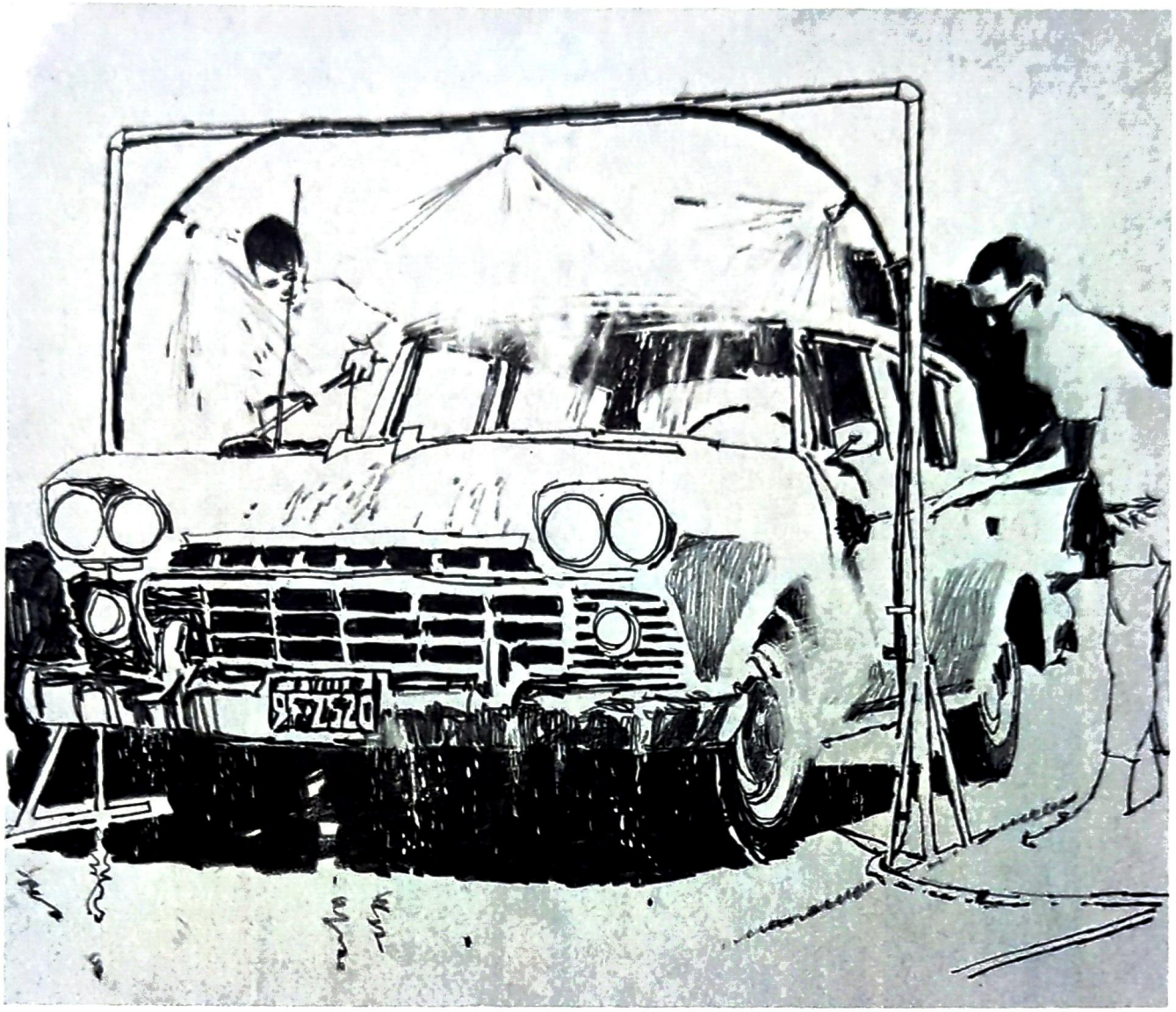
You needn't draw circles in laying out work —just mark center lines for uniform spacing. Line these up with the guide mark on the clamped fence, as you can see.

The center-line system also works when your workpiece is receiving only part of a cut, for example, as in constructing a picture frame as shown in the illustration.

You'll probably develop some of your own tricks for short-cuts, but one faster way to make edge-carved moldings is to cut full circles and slice them in half. Two center cuts dispose of the pilot holes and give you two identical strips as shown in the illustration.

See also: bowl; cheese board; honing; novelties; signs; tiki god; whittling.

Faster way to make edge-carved moldings is to cut full circles and slice them in half. Two center cuts dispose of pilot holes



Build a five-minute car wash

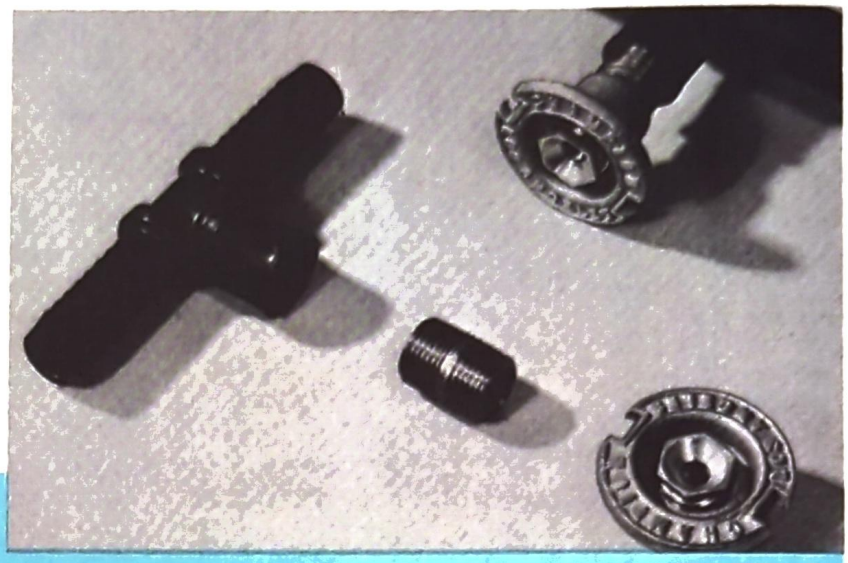
By MANLY BANISTER

ENTERPRISING TEEN-AGERS who have outgrown the paper route, also the car owner who likes a quick wash to keep his car sparkling new, will go for this speedy portable car washer. Its sprinkler heads, from a lawn sprinkler system, form a dirt-removing spray ring that hits every exposed inch of the car as it is driven slowly through the arch. The whole affair can be disassembled and bundled in minutes for moving to a new location or for storing.

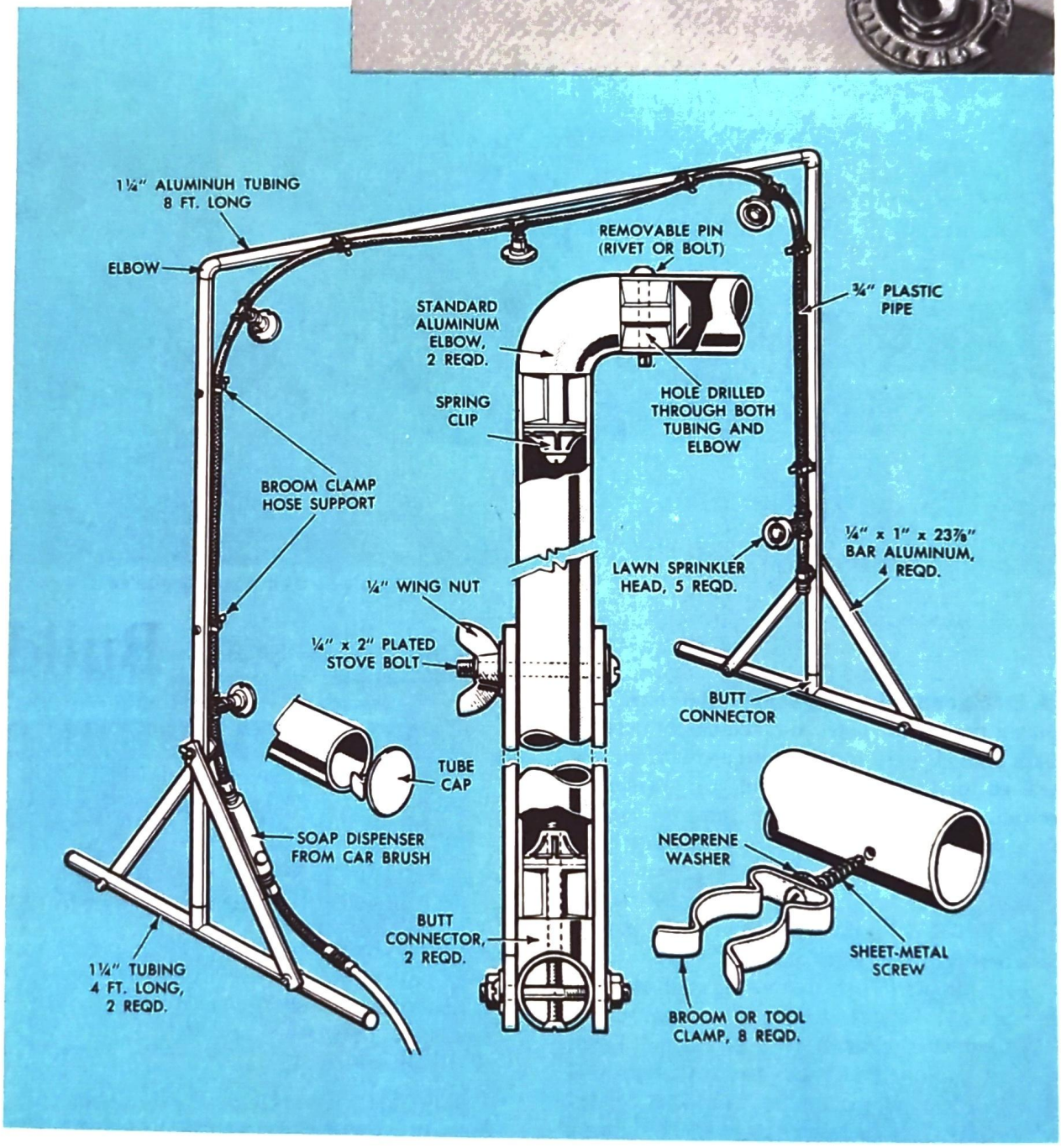
To assemble this washer you'll need one 8-ft. and two 6-ft. lengths of 1¼-in. aluminum tubing, two aluminum elbows, two aluminum T-butt connectors, four end caps, one 8-ft. length of ¼ x 1-in. bar aluminum, six ¼ x 2-in. plated stove bolts with lock washers, two ¼-in. wing

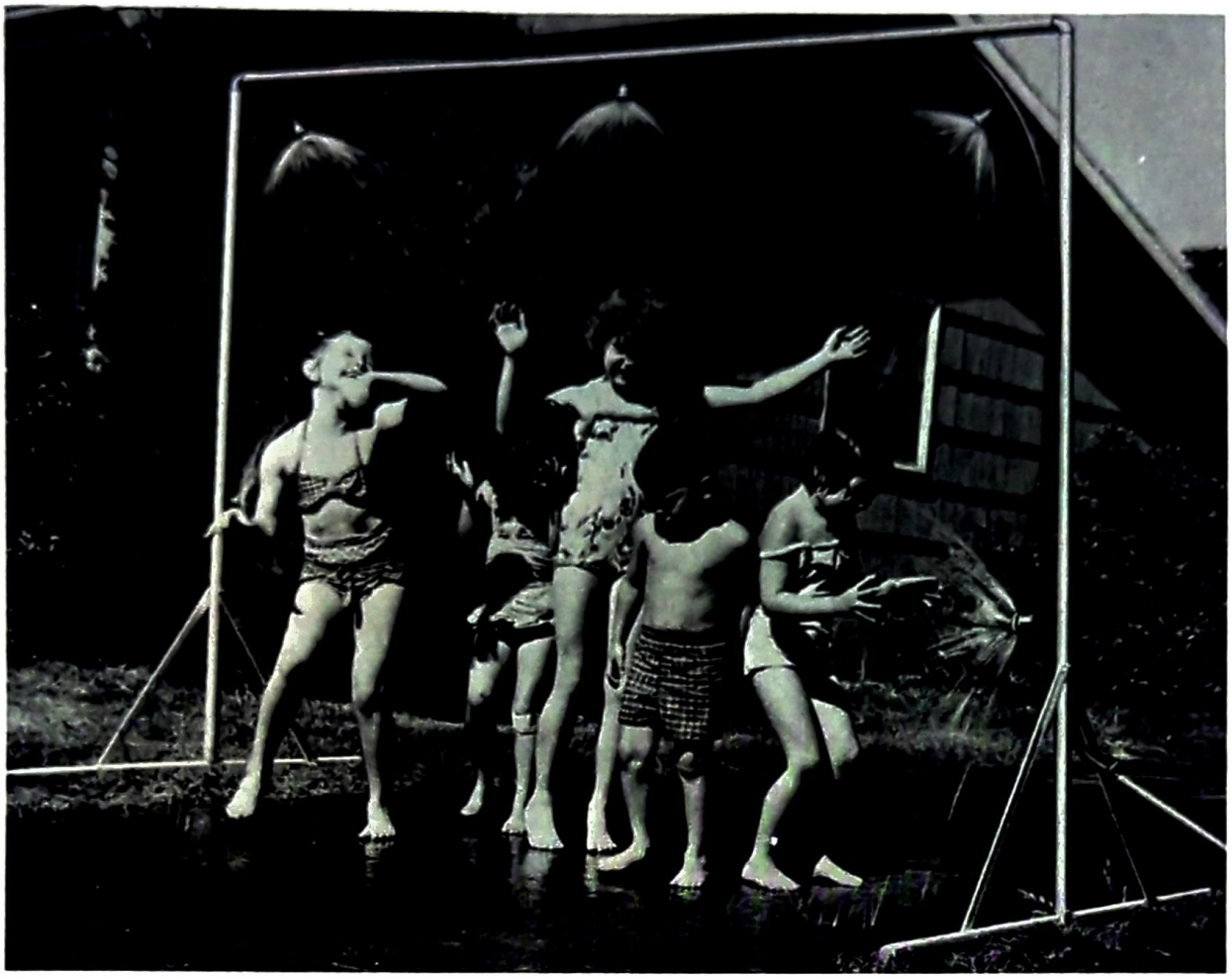
casehardening: see smelting furnace
case, jewelry: see jewelry case
cask lamp: see lamps
casting: see fly-casting

A strong jet spray is provided by five sprinkler heads of the type used in underground lawn sprinkler systems



build a car wash, continued


1¼" ALUMINUH TUBING 8 FT. LONG
ELBOW
REMOVABLE PIN (RIVET OR BOLT)
¾" PLASTIC PIPE
STANDARD ALUMINUM ELBOW, 2 REQD.
HOLE DRILLED THROUGH BOTH TUBING AND ELBOW
SPRING CLIP
BROOM CLAMP HOSE SUPPORT
¼" x 1" x 23⅞" BAR ALUMINUM, 4 REQD.
LAWN SPRINKLER HEAD, 5 REQD.
¼" WING NUT
¼" x 2" PLATED STOVE BOLT
BUTT CONNECTOR
TUBE CAP
SOAP DISPENSER FROM CAR BRUSH
NEOPRENE WASHER
BUTT CONNECTOR, 2 REQD.
SHEET-METAL SCREW
1¼" TUBING 4 FT. LONG, 2 REQD.
BROOM OR TOOL CLAMP, 8 REQD.



The washer will clean both the car and the kids to make it doubly useful on a hot day

nuts, 18 ft. of ¾-in. plastic pipe, five ¾-in. plastic-pipe tees with five ½-in. close nipples, five sprinkler heads, eight tool or broom clamps, a male hose coupling with cap and a female hose coupling for connecting a garden hose. You should be able to buy all the parts for about $25.00. If you wish, you can salvage the soap dispenser from a car-washing brush and connect to the plastic hose just below the first sprinkler head.

The aluminum tubing and the fittings that go with it can be obtained at any hardware store selling do-it-yourself aluminum. You also can use pipe and slip-on fittings for the hose-supporting framework, and it's possible to adapt the assembly to standard threaded pipe and fittings. The elbow and butt fittings used in the original are of the type having an expandable spring clip which wedges inside the tubing when a machine screw is drawn up.

The close-up sectional detail on the preceding page shows how the T-butt connectors and the elbows join the tubing. You'll note that the T-butt connectors are designed to straddle the curvature of the joining tubing, and that the elbows are locked permanently in the upper ends of the vertical members but not in the horizontal member. The horizontal member is merely pinned to the elbows so that the hose supporting framework can be dismantled easily when desired. Here, a hole is drilled crosswise through both the tubing and the elbow to receive a loose fitting rivet, nail or bolt. In this case, the spring clip and the screw are discarded.

Four 44-in. lengths of plastic pipe are used between the sprinkler heads and these are joined to the heads by merely pressing the ends over the special T-fittings. Pipe-joint compound is applied to the ends of the close nipples you get with the sprinkler heads, the nipples are turned in the tees and the sprinkler heads screwed on. The final sprinkler head may be screwed into an end-of-the-line elbow.

Because it is easily moved anywhere, this car washer also makes a good place for the kids to play on a hot day. They'll enjoy running through it, sitting under it, and just using it to cool off.

See also: auto repair; cleaning, auto; used car reconditioning.

Build a sailing cat

Sleek, stable and speedy, this easily built plywood catamaran is demountable for car-topping and is very easy on the pocketbook

Length: 11 ft. 10 in., o.a.
Beam: 7 ft. 10 in., o.a.
Sail area: 120 sq. ft.
Weight: 200 lbs.
Construction: plywood
Designers: Seymour Paul
Glen L. Witt

EVERYTHING ABOUT this small cat is easy. The slim 80-lb. hulls are light enough for car-topping and small enough to be stowed on the rafters in your garage during the off-season. Furthermore, with a beam of only 2 ft., the hulls don't require a large building floor.

It's even easy on your pocketbook. You can build *El Gato* for about $500 below what you'd pay for a commercial fiberglass cat of the same size. (In case you're wondering, "gato" is Spanish for cat.)

Single-handing El Gato's cat rig is a breeze, yet the 4 x 5-ft. cockpit is roomy enough to hold two or three people if you care for company. Two men can have the boat assembled and ready to sail in only 15 minutes; it's just a matter of tightening 12 bolts and stepping the mast. In short, *El Gato* is a fast, fun and frugal way of getting into the hottest thing under canvas today—the sailing catamaran.

General instructions regarding the selection of

catches, cabinet: see hardware
caterpillars: see insect control
cathead: see lathe accessories
caul bending: see wood bending

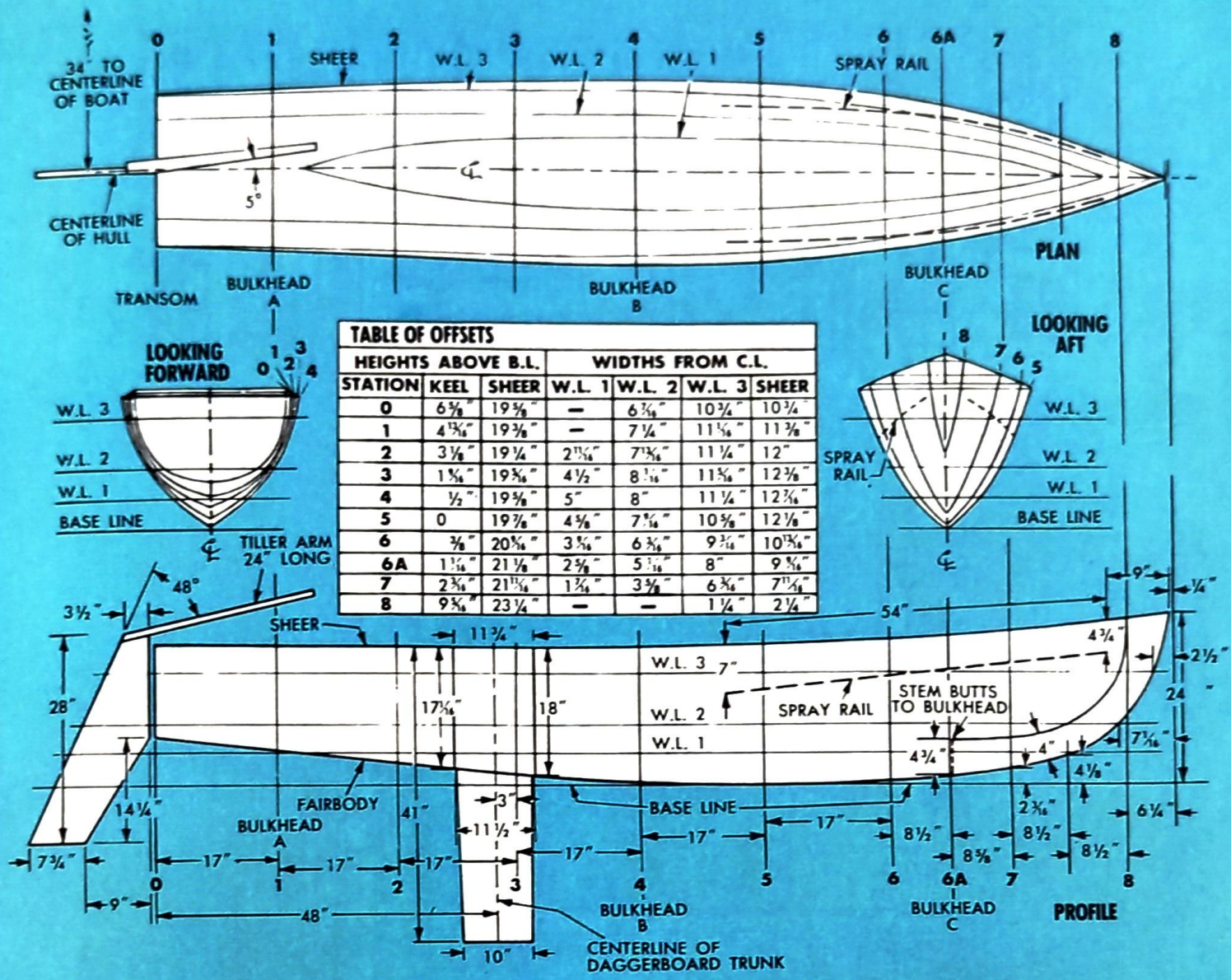
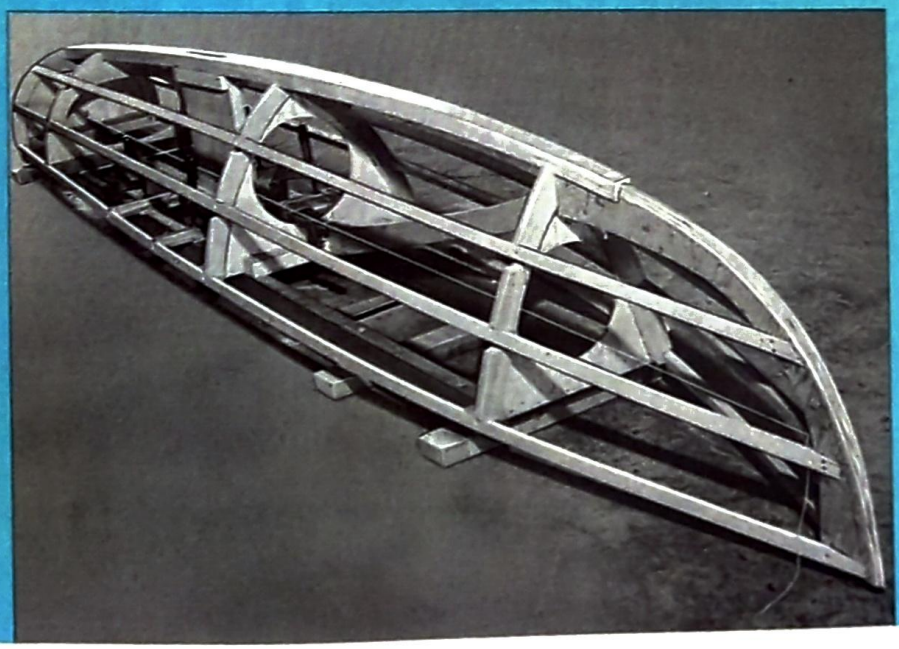
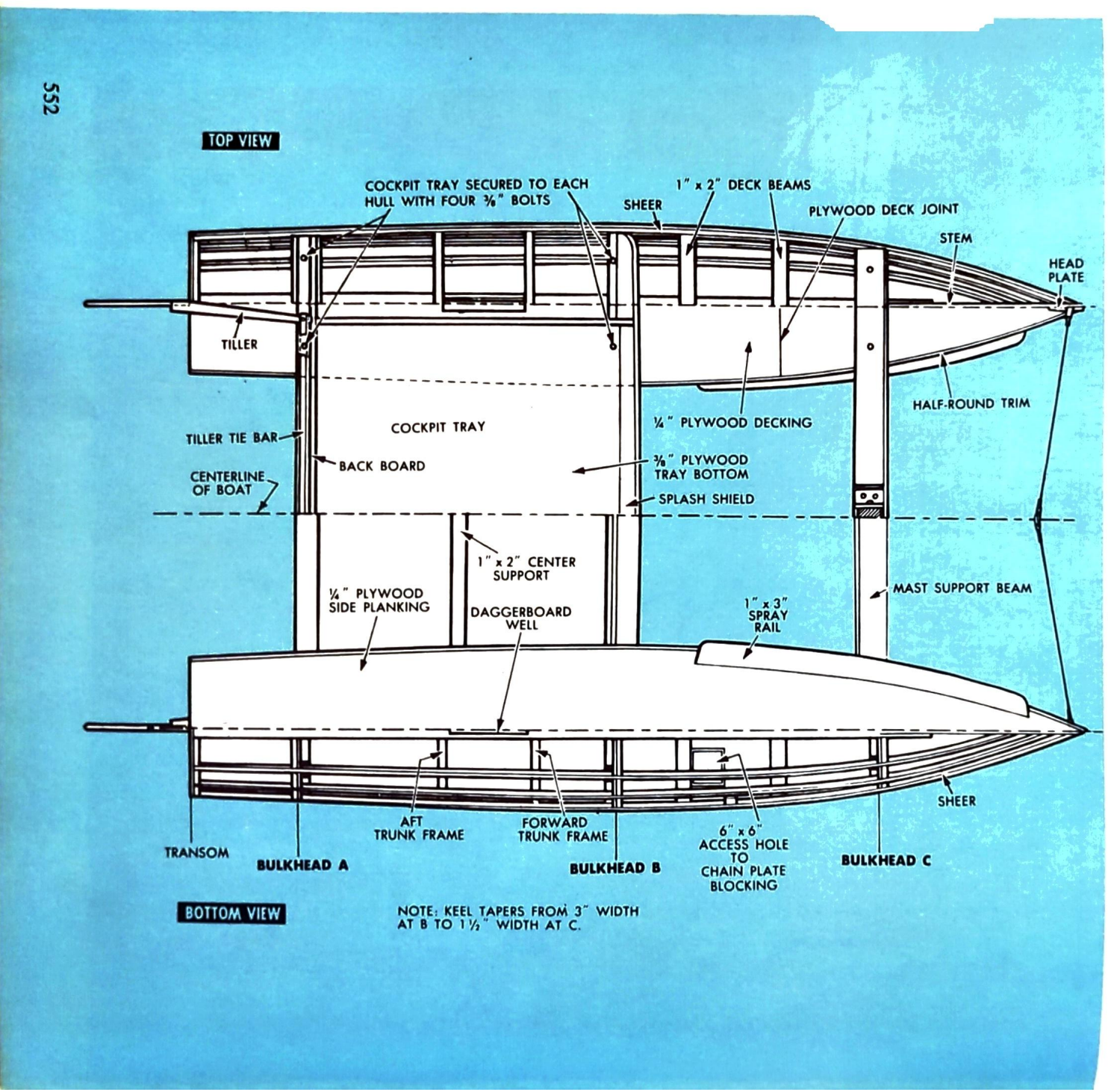


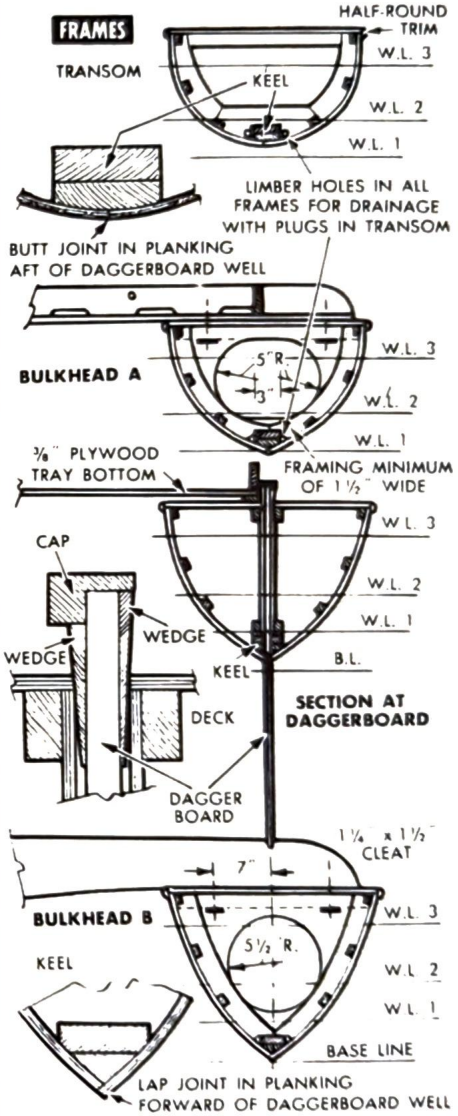
TABLE OF OFFSETS

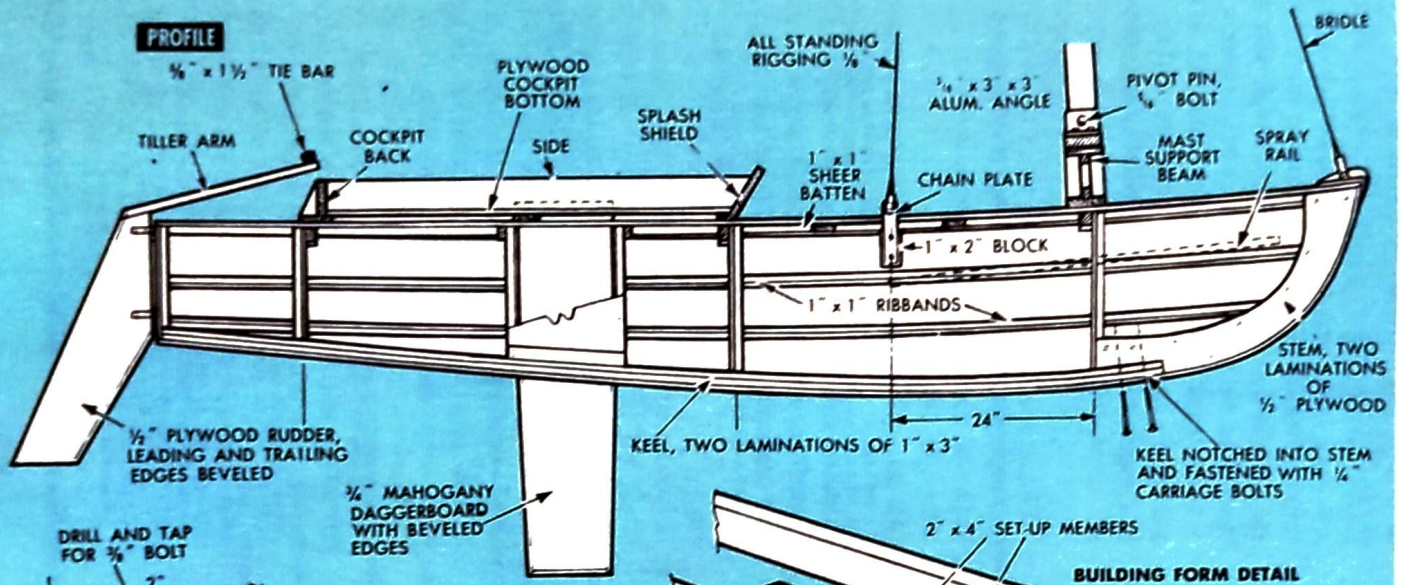
	HEIGHTS ABOVE B.L.		WIDTHS FROM C.L.			
STATION	KEEL	SHEER	W.L. 1	W.L. 2	W.L. 3	SHEER
0	6⅝"	19⅝"	—	6⅞"	10¾"	10¾"
1	4 13/16"	19⅜"	—	7¼"	11 1/16"	11⅜"
2	3⅛"	19¼"	2 11/16"	7 13/16"	11¼"	12"
3	1 5/16"	19 3/16"	4½"	8 1/16"	11 5/16"	12⅜"
4	½"	19⅛"	5"	8"	11¼"	12⅜"
5	0	19⅛"	4⅝"	7 15/16"	10⅝"	12⅛"
6	⅜"	20 1/16"	3 5/16"	6 5/16"	9 5/16"	10 13/16"
6A	1 1/16"	21⅛"	2⅝"	5 1/16"	8"	9 5/16"
7	2 3/16"	21 11/16"	1⅞"	3⅝"	6 3/16"	7 11/16"
8	9 5/16"	23¼"	—	—	1¼"	2¼"

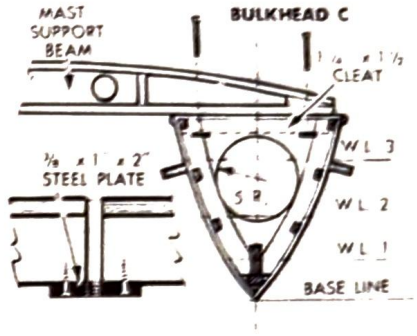


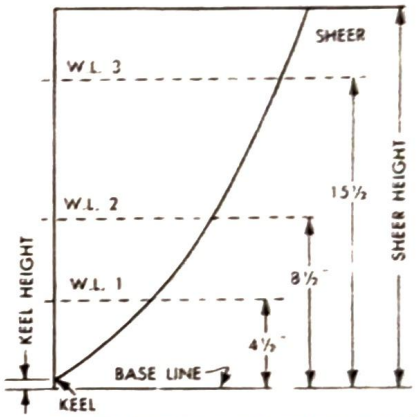
One big advantage in building a catamaran is that you can use the same building form for both hulls. Note the brace between bulkheads B and C which holds them in line while the framing is being installed


TOP VIEW
COCKPIT TRAY SECURED TO EACH HULL WITH FOUR ⅜" BOLTS
SHEER
1" x 2" DECK BEAMS
PLYWOOD DECK JOINT
STEM
HEAD PLATE
TILLER
COCKPIT TRAY
¼" PLYWOOD DECKING
HALF-ROUND TRIM
TILLER TIE BAR
BACK BOARD
⅜" PLYWOOD TRAY BOTTOM
CENTERLINE OF BOAT
SPLASH SHIELD
1" x 2" CENTER SUPPORT
¼" PLYWOOD SIDE PLANKING
DAGGERBOARD WELL
MAST SUPPORT BEAM
1" x 3" SPRAY RAIL
AFT TRUNK FRAME
FORWARD TRUNK FRAME
6" x 6" ACCESS HOLE TO CHAIN PLATE BLOCKING
SHEER
TRANSOM
BULKHEAD A
BULKHEAD B
BULKHEAD C
BOTTOM VIEW
NOTE: KEEL TAPERS FROM 3" WIDTH AT B TO 1½" WIDTH AT C.


FRAMES
HALF-ROUND TRIM
TRANSOM
KEEL
W.L. 3
W.L. 2
W.L. 1
LIMBER HOLES IN ALL FRAMES FOR DRAINAGE WITH PLUGS IN TRANSOM
BUTT JOINT IN PLANKING AFT OF DAGGERBOARD WELL
BULKHEAD A
5" R.
3"
⅜" PLYWOOD TRAY BOTTOM
FRAMING MINIMUM OF 1½" WIDE
CAP
WEDGE
WEDGE
KEEL
B.L.
DECK
SECTION AT DAGGERBOARD
DAGGER BOARD
1¼" x 1½" CLEAT
7"
BULKHEAD B
5½" R.
KEEL
BASE LINE
LAP JOINT IN PLANKING FORWARD OF DAGGERBOARD WELL







METHOD OF LAYING OUT BULKHEADS AND TRANSOM IS SHOWN ABOVE.

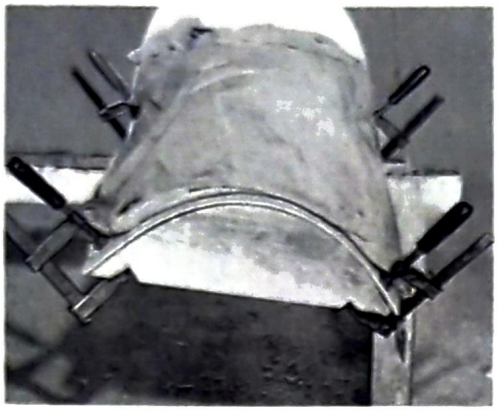
THE HEIGHTS OF W.L. 1, 2 AND 3 ARE THE SAME AT EACH STATION.

THE HEIGHTS AND WIDTHS OF EACH STATION ARE NOTED IN THE TABLE BELOW.

USE A BATTEN TO DRAW THE ARC FROM KEEL TO SHEER.

ALL BULKHEADS ARE SYMMETRICAL ABOUT THE CENTERLINE.

STATION	HEIGHTS		WIDTHS			
	KEEL	SHEER		W.L. 2	W.L. 3	SHEER
O	6⅛"	19⅜"	—	6⅞"	10¾"	10¾"
A	4¹³⁄₁₆"	19⅜"	—	7¼"	11⅛"	11⅜"
B	½"	19⅜"	5"	8"	11¼"	12⅝"
C	1⅛"	21⅛"	2⅜"	5⅛"	8"	9⅛"



Pre-forming of the planking over a bending block makes it easier to install. When mounting planking, below, hold to the sheer

materials and fastenings are given on this page. Remember that all joints should be both glued and screwed. Before you begin construction, go over the plans carefully to make sure that everything is perfectly clear. Then start by assembling the bulkheads.

Working one frame at a time, lay out one half of the bulkhead directly on the ¼-in. plywood. Since you will need duplicate bulkheads for the twin hulls, tack a second piece of plywood directly under the first so that you can saw both out at the same time. After cutting one half, separate the two pieces of plywood, flip the top one over, relocate it on the centerline and use it as a cutting pattern for the other half.

The framework for each bulkhead should be cut from 1-in.-thick material trimmed to a minimum width of 1½ in. After coating mating surfaces liberally with glue, nail through the plywood into the frame with 1-in. nails. Secure a 1½ x 1¼-in. cleat at the top of each bulkhead on the side opposite the framework. When cutting the framing for bulkhead C, remember to notch it

Materials List

LUMBER. All lumber should be clear first-grade "four-quarters" finished as full as possible. Thus, lumber noted as 1" will usually have a finished thickness of from ¾" to ⅞". All other thicknesses are net, as are all widths. All lengths given allow for cutting and trimming to size. This list is intended as a general guide only and should not be used to purchase materials until the dimensions have been checked against the work and reviewed for possible options. Considerable over-all saving will result from grouping pieces having the same width and thickness to be resawed to required size later. The use of lighter lumbers, such as Sitka spruce or Philippine mahogany, is preferable to framing with white oak or other heavier species.

No. of Pcs.	Size	Item
2	1" x 8" x 9'6"	Bulkhead, transom and daggerboard trunk frame
1	1¼" x 1½" x 12'	Bulkhead top cleat
12	1" x 1" x 12'	Sheer and ribbands
4	1" x 3" x 11'	Keel laminations
2	1" x 5" x 4'	Cockpit sides
1	½" x 8" x 8'	Cockpit splash shield
1	1" x 4" x 8'	Cockpit back
2	1" x 1½" x 4'	Cockpit side cleats
1	1" x 3½" x 8'	Cockpit back cleat
1	1" x 1¾" x 8'	Cockpit splash shield cleat
1	1" x 2" x 6'	Cockpit center batten
1	1" x 6" x 8'	Mast beam upright
1	1" x 4" x 8'	Mast beam base
1	½" x 4" x 8'	Mast beam top
1	1" x 12" x 8'	Daggerboards
	Misc. blocking as required	

PLYWOOD. Exterior Douglas fir is satisfactory in all cases, though some may prefer to use mahogany for appearance. Naturally, marine plywood (solid core) is preferable for planking and may be substituted for exterior plywood. Likewise, you can make the boat lighter and slightly faster without decreasing the structural strength materially by using 3/16" plywood for planking. Regardless of thickness, however, all plywood should have a minimum of three plies, and any thicker than ⅜" at least five plies.

Pcs. No. of	Size	Item
1	½" x 4' x 8'	Stem laminations, rudder
1	¼" x 4' x 8'	Bulkheads, transom, daggerboard trunk sides
2	¼" x 4' x 8'	Decking
2	¼" x 4' x 12'	Planking
1	⅜" x 4' x 6'	Cockpit floor

FASTENINGS. All fastenings should be bronze or hot-dipped galvanized. Brass isn't recommended due to its tendency to fracture under stress. Nails should be annular-ring type (Stronghold, Anchorfast or similar).

Screws: Flatheaded woodscrews
- 1" No. 8 — 5 gross
- 1½" No. 8 — 3 gross

Nails: Annular ring, bronze
- 1" No. 12 — 5 lbs.

Bolts: Carriage-type, with nuts and washers
- ¼" x 4½" — 2 required
- ¼" x 5" — 2 required

Glue: Resorcinol or urea resin type, either 1 gal. or 5 lbs., depending on type selected

Specialty Items:

Plates: ⅜" x 1" x 2" brass or galvanized steel with tapped hole, 12 required

Bolts: ⅜"-dia. USS machine bolts, bronze or steel, with flat washers. Check lengths against work:
- Cockpit to hull—3½" long, 8 required
- Mast beam to hull—4" long, 2 required
- Mast beam to hull—7" long, 2 required

After planking the hulls, it's a good idea to make a couple of cradles to hold each one upright during the rest of construction. Use scrap plywood

Spray rails molded to a width of about 2 in. must be fitted to the hull by trial and error to assure perfect fit. Mount with screws driven from inside

for the stem since this member is designed to fit between the framing pieces and butt to the plywood.

Follow the same procedure with the transom, but be sure to notch the framework for the ribbands, sheer clamps and keel before assembly since these don't extend through the plywood. Space the ribbands evenly between the keel and sheer clamps.

The stem is built up from two laminations of ½-in. plywood. Coat matching surfaces liberally with glue and nail the two pieces together with 1-in. nails spaced 3 in. apart.

Use ¼-in. plywood for the sides of the daggerboard trunk and 1 x 1-in. cleats to form the slot. Note that the vertical dimensions for the trunk layout are taken from a straight line which isn't parallel to the sheer. After coating the cleats with glue, nail them to one of the sides. Then nail a 1½-in.-wide bed-log on the opposite side of this piece at the bottom. Assemble the other half of the trunk with only the bed-log and upper cleat.

The inside of the daggerboard trunk must be either painted or covered with fiberglass before the two halves are assembled. If you decide to use fiberglass, lap it over the 1 x 1-in. cleats which form the slot and cover the inner surface of the other half completely. Then, while both surfaces are still tacky, fasten the two halves together with 1-in. nails. To complete the trunk, attach the 1 x 1½-in. fore and aft beams, notching them to fit around the sheer clamps.

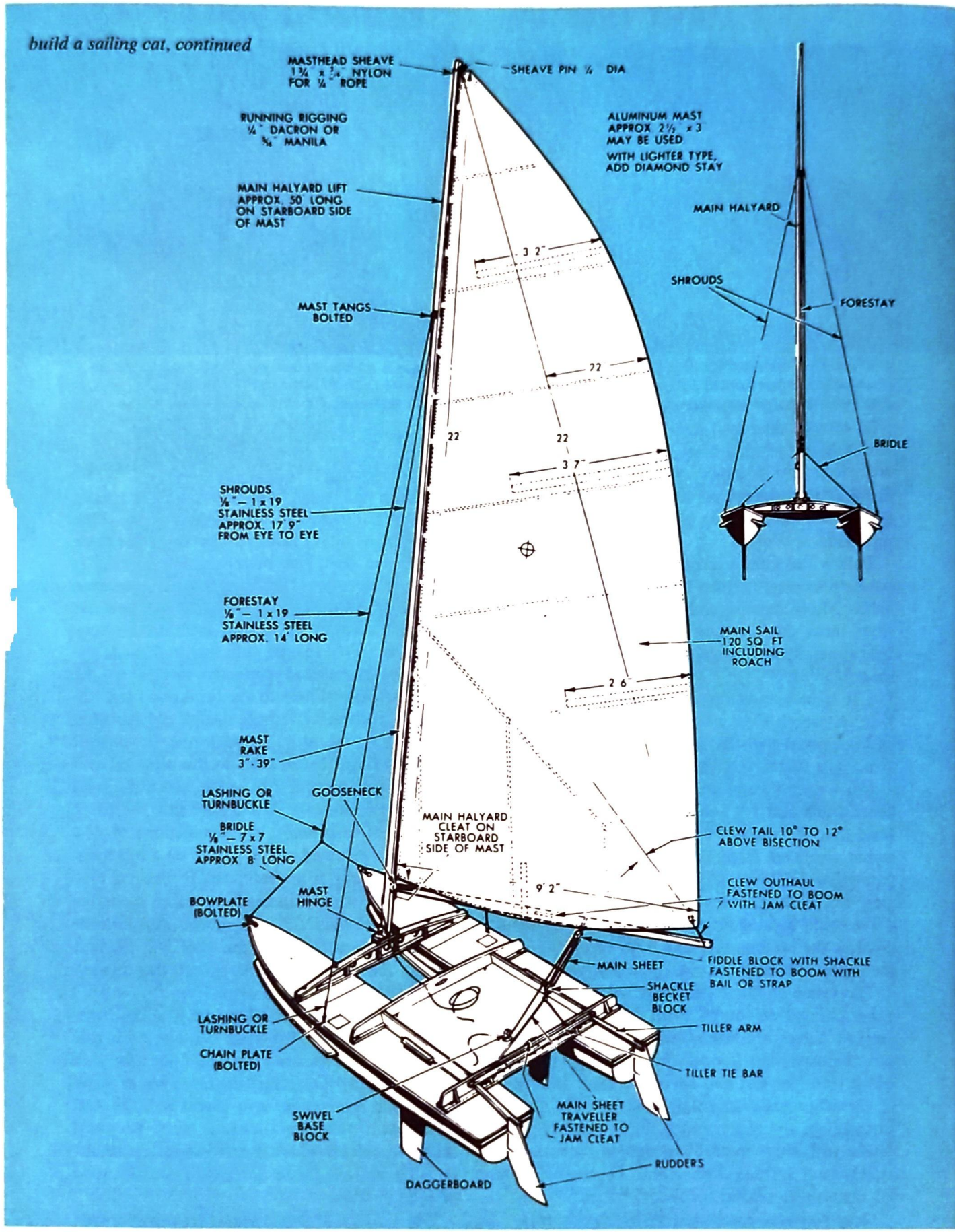
Once you have completed the bulkheads, transom, stem and daggerboard trunk, you are ready to assemble them on the building form. This form may be either fastened directly to the floor or mounted on a pair of saw horses to raise it to a more convenient working height. A cord or wire stretched down the centerline between the stem and transom will assure accurate positioning of the bulkheads. Be sure that bulkheads are correctly spaced and perfectly vertical to the form, then brace them to the form or to one another to prevent movement during construction. Finally, slip the stem between the framing of bulkhead C so that it butts to the plywood and fasten it with several 1-in. nails, using the stem support member to hold the bow end.

The keel is actually two laminations of 1 x 3-in. stock mounted one at a time on the frames. It tapers evenly from bulkhead B forward to a width of 1½ in. at bulkhead C. Before mounting the first keel lamination, bevel the keel notches in the bulkheads so that the keel will fit flush against the framework. Also, cut the daggerboard slot in both laminations.

Fasten the initial keel lamination to the bulkheads and daggerboard-trunk bed-logs with glue and 1½-in. screws, then coat this liberally with glue and apply the second directly over it. After the second lamination is in place, bolt the keel to the stem with ¼-in. carriage bolts. To avoid fairing problems later, recess the heads of the bolts deeply and locate screws on the centerline of each bulkhead.

The 1 x 1-in. ribbands should be spaced evenly

build a sailing cat, continued


MASTHEAD SHEAVE 1¾ x ⅞ NYLON FOR ¼ ROPE
SHEAVE PIN ¼ DIA
RUNNING RIGGING ¼ DACRON OR ⅜ MANILA
ALUMINUM MAST APPROX 2½ x 3 MAY BE USED WITH LIGHTER TYPE, ADD DIAMOND STAY
MAIN HALYARD LIFT APPROX. 50 LONG ON STARBOARD SIDE OF MAST
MAIN HALYARD
3 2
SHROUDS
FORESTAY
MAST TANGS BOLTED
22
22
22
BRIDLE
3 7
SHROUDS ⅛ — 1 x 19 STAINLESS STEEL APPROX. 17' 9" FROM EYE TO EYE
FORESTAY ⅛ — 1 x 19 STAINLESS STEEL APPROX. 14' LONG
MAIN SAIL 120 SQ. FT. INCLUDING ROACH
2 6
MAST RAKE 3"-39"
LASHING OR TURNBUCKLE
GOOSENECK
BRIDLE ⅛ — 7 x 7 STAINLESS STEEL APPROX 8' LONG
MAIN HALYARD CLEAT ON STARBOARD SIDE OF MAST
CLEW TAIL 10° TO 12° ABOVE BISECTION
BOWPLATE (BOLTED)
MAST HINGE
9' 2"
CLEW OUTHAUL FASTENED TO BOOM WITH JAM CLEAT
MAIN SHEET
FIDDLE BLOCK WITH SHACKLE FASTENED TO BOOM WITH BAIL OR STRAP
SHACKLE BECKET BLOCK
LASHING OR TURNBUCKLE
TILLER ARM
CHAIN PLATE (BOLTED)
TILLER TIE BAR
SWIVEL BASE BLOCK
MAIN SHEET TRAVELLER FASTENED TO JAM CLEAT
RUDDERS
DAGGERBOARD

at bulkhead C, approximately dividing it into thirds on either side of the centerline. Where they contact the stem, a long taper and slight twist will be required in order to make them mate properly with the planking. Secure them with glue and one 1½-in. screw at each point.

Mount the 1 x 1-in. sheer clamps in the same way. It's important that these members form a clean curve with no irregularities. Bevel each one to fit against the stem, and after removing the stem support, fasten as you did the ribbands. Finally, hand-fit the two deck spreader beams between the sheer clamps forward of bulkhead B, and you are ready to begin fairing.

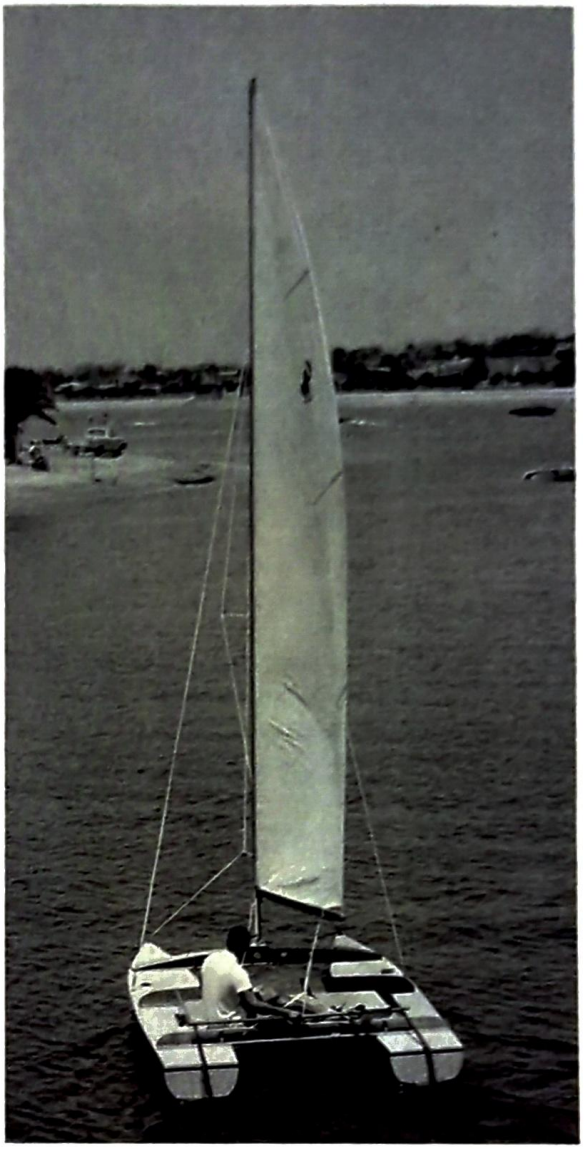
file keel notches

Fairing is really just bevelling the framework so that the planking will fit flush against it. Starting along the keel at the stern, file notches which follow the contour of the bulkheads and then use a plane to bevel the edges of the keel to the depth of these notches. When fairing bulkhead framework, undercut the edges slightly to avoid projections. Once the framework is faired, cut notches in each bulkhead next to all longitudinals to enable the bilge water to drain aft and install drain plugs on either side of the keel at the transom.

Planking the hull is probably the most difficult step in construction, but you won't run into any real problems if you adhere to the following procedure. Since the ¼-in. plywood is stiff and difficult to bend without soaking, it's important that you "pre-form" it on a 2-in. bending block cut to the contour of the transom. After cutting the 4 x 12-ft. sheet lengthwise, place one half over two of these bending blocks spaced about 6 ft. apart and cover it with burlap sacks. Then, after pouring hot water over the burlap-covered plywood and allowing sufficient time for it to penetrate, slowly bend the planking to the arc of the form.

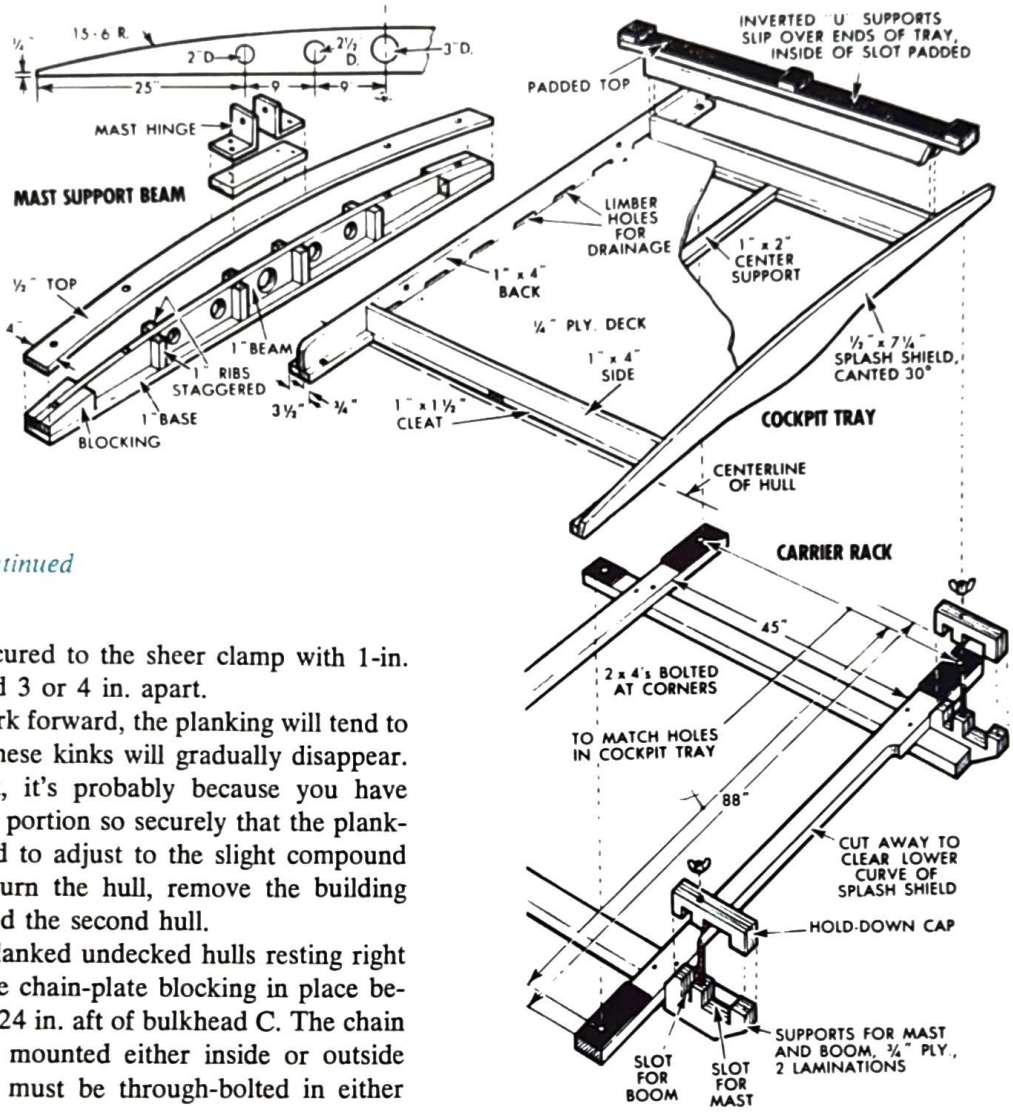
Clamp the panel in place and allow it to dry overnight. When removed from the form, the plywood will retain most of its curvature, making it possible for one man to plank the hull with ease. If 3/16-in. planking is used, the process will be even simpler since the thinner plywood is quite a bit easier to bend.

When fitting the planking to the hull, tack or clamp it to the sheer clamp and lean against the side to press it into position along the keel. Then mark it and rough-cut it to shape. You'll find that there is very little surplus at the ends and the width will be as much as a ¼-in. shy in some places along the keel. However, this can be taken care of with a filler strip once the planking is installed.



The excess planking forward of the daggerboard opening on the initial panel will be beveled after installation, and you can use a back saw to cut the planking along the keel centerline aft of this point.

Coat all mating surfaces with glue, and after locating the panel on the framework, begin fastening it in place about midway along the sheer clamp. Moving from this point toward the transom, work the roll in at the transom with either clamps or screws not fully tightened. Secure the planking to the transom with 1-in. screws spaced approximately 1 in. apart. The planking need not be screwed to the bulkheads or ribbands, but

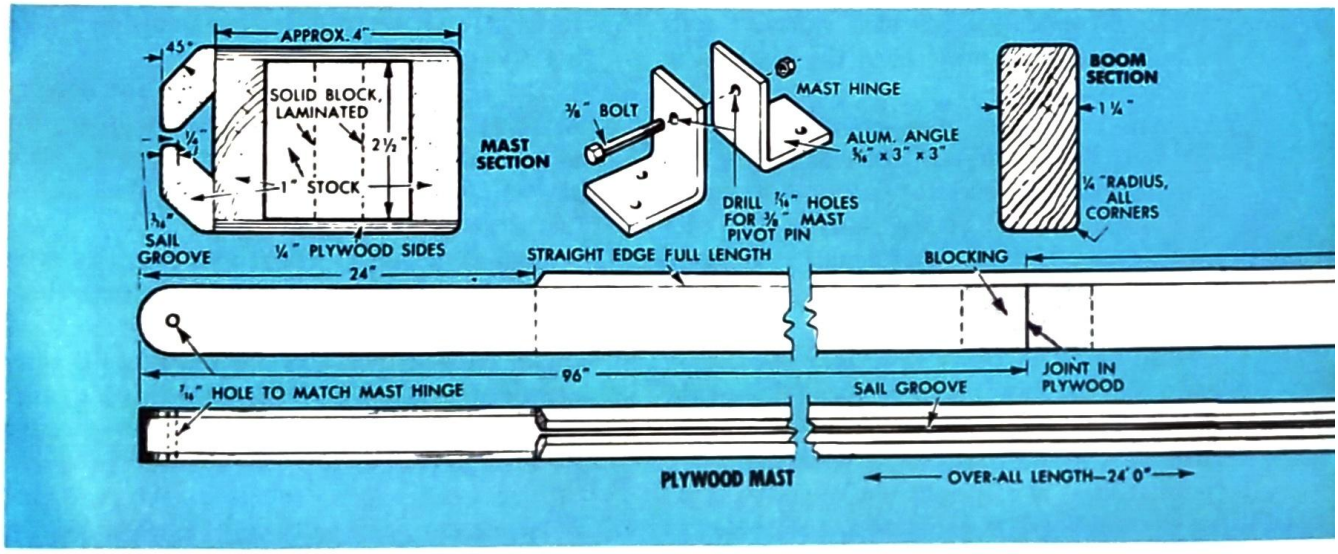


build a sailing cat, continued

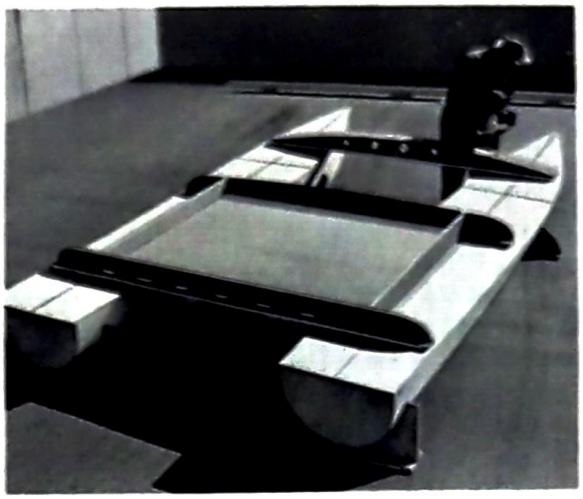
should be secured to the sheer clamp with 1-in. screws spaced 3 or 4 in. apart.

As you work forward, the planking will tend to buckle, but these kinks will gradually disappear. If they don't, it's probably because you have anchored one portion so securely that the planking can't bend to adjust to the slight compound curve. Now turn the hull, remove the building form and build the second hull.

With the planked undecked hulls resting right side up, fit the chain-plate blocking in place below the sheer 24 in. aft of bulkhead C. The chain plates can be mounted either inside or outside the hulls, but must be through-bolted in either



Before decking the hulls, run mounting bolts through the holes in the cleats to make sure that tapped steel bulkhead plates are in perfect alignment



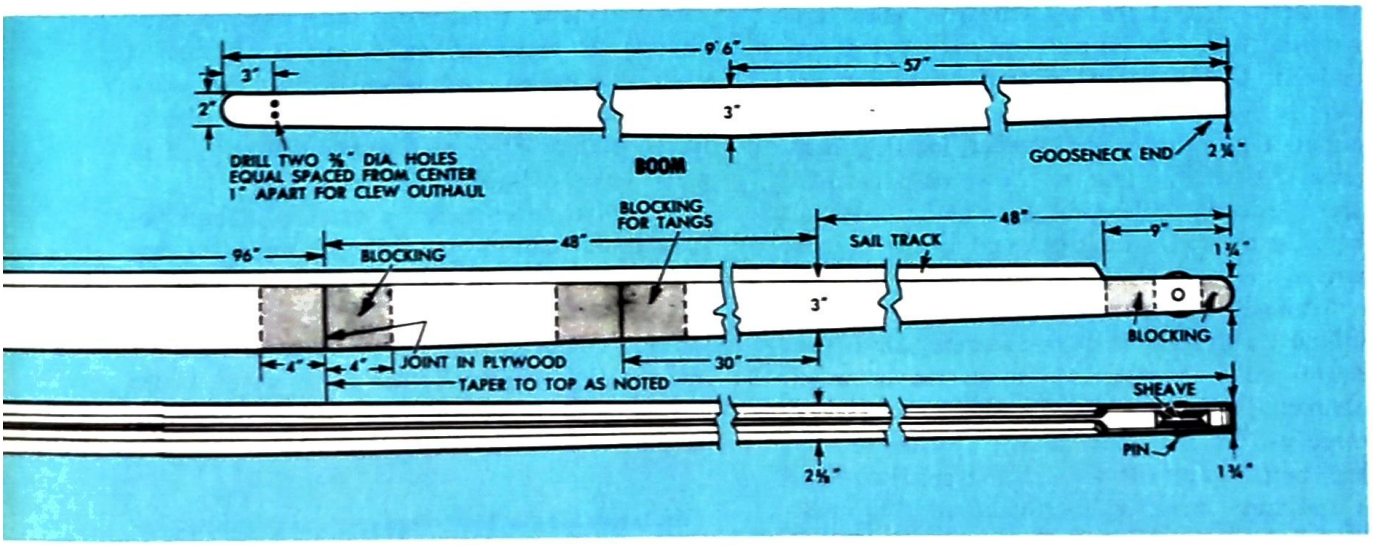
Check the hull alignment by measuring from the center line at the transom to the center line at bulkhead C on the opposite hull.

case. However, don't install these until the hulls have been decked.

One 4 x 8-ft. panel of ¼-in. plywood is sufficient to deck each hull, using a butt joint reinforced by the forward deck beam. After fairing the deck framing, rough cut the panels and temporarily tack them in place for final trimming. Then remove the decking and coat the inside of the hull with an anti-rot preservative (Cuprinol, Penta, or similar). The spray rails must be hand-fitted to the contour of the hull and fastened from the inside.

The mast support beam, detailed on page 558, is a simple construction which should present no problems. After you have assembled it, lay the beam aside before drilling the bolt holes and complete the cockpit tray. The construction diagram of the tray is self-explanatory. The only feature which doesn't show is a 1-in. reinforcing block 3 in. square which should be installed on the underside to serve as backing for the mainsheet swivel block.

When you have completed both the tray and the beam, align the hulls in an upright position the proper distance apart and place these two components on top of them so that the locations for the assembly bolt holes can be marked. After marking, remove the beam and tray for



drilling. To assure making these holes perfectly vertical, either use a drill press or have a friend help guide the drill by sighting. When you have drilled all twelve holes, replace the beam and drill mating holes in the deck.

Locate the mast support beam over bulkhead C and drill down through the top cleat, using the holes in the beam as a drilling guide. Do the same thing with the cockpit tray, positioning it so that the holes will pass through the top cleats of bulkheads A and B. After all holes have been drilled, remove the beam and tray and take off the deck planking so that the steel bulkhead plates can be installed on the underside of the cleats. The cleat should be mortised slightly to hold the plate in position so that the bolt will pass through the hole and contact the threads.

Now you can secure the decking permanently to the hull. Coat all mating surfaces with glue and fasten the plywood in place by nailing around the edge with 1-in. nails spaced about 2 in. apart. Either cut an access hatch in the indicated location or use a metal deck plate for ventilation.

bevel generously

The two daggerboards should be generously bevelled fore and aft with a somewhat steeper bevel on the bottom edge. The rabbeted block at the top will prevent warping, while the wedges serve to center each board in the slot and hold it securely. If the fit of the daggerboard slot is firm enough, you won't need any hold-down. However, if the fit is slightly loose, a shock cord may be necessary to hold it in the down position.

Construction of the two rudders is somewhat similar to that of the daggerboards. These are cut from ½-in. exterior plywood and tapered fore and aft. Use standard pintle and gudgeon fittings to assemble the rudders to the hulls. After bolting tiller arms to each rudder, locating them about 5 deg. off center, as shown on pages 552 and 553, connect the arms with a ⅝ in. x 1½ in. bar. Use a ¼-in. carriage bolt and washer at each arm to serve as a pivot.

While the mast shown is made of plywood reinforced with solid blocking at stress points, you might prefer to purchase one of the extruded aluminum type. Anything from 2½ in. to 3 in. or more will be adequate, though a diamond stay may be required with the lighter type. Naturally, a sail track may be substituted for the mast grooves.

The boom should be of Sitka spruce, if possible, with the top edge straight and the bottom edge in a symmetrical curve. The locations of the main sheet blocks may be varied to suit individual tastes.

Drill two ⅜-in. holes in the aft end for the clew outhaul, generously rounding the edges to avoid unnecessary wear. The outhaul threads through these holes and is secured to a jam cleat located on the boom. (Again, the exact location is a matter of personal preference.) If you wish, a ¼-in. wide groove ½-in. deep may be cut in the aft end of the boom for the clew outhaul, in which case the holes can be eliminated.

have your sail made

Any reputable sailmaker will be able to fabricate the sail from the dimensions given in the drawing on page 556. Don't mount the gooseneck in the mast until you have obtained the sail, since it may be necessary to compensate for the exact length.

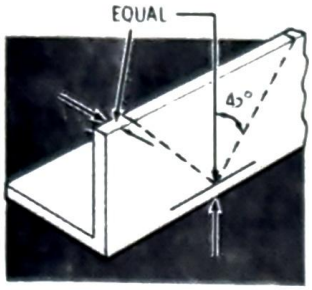
Fiberglassing is optional, though it is recommended that you at least glass the seams. Give all areas which haven't been glassed a coat of plywood sealer followed by a flat primer sanded smooth and at least two coats of marine enamel. All natural wood surfaces should be given at least three (and preferably five) coats of varnish. Once you've either glassed or painted the boat, it's ready for the water.

For ease of upkeep, it's a good idea to completely fiberglass all exposed parts. A good glass job pays for itself several times over in paint and elbow-grease savings, and you can get the boat into the water a lot faster when the season opens.

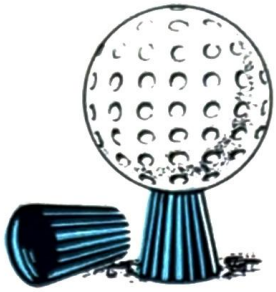
A final word of caution: *El Gato* is a very inexpensive boat to build in terms of the materials you have to buy. But take pains in purchasing the right materials, making all cuts to exact dimensions, and doing all assembly work with great care. Some patience and double-checking in putting *El Gato* together will pay off in many hours of sailing enjoyment.

If you've never sailed a catamaran hull before, you'll want to play with this one for a day or so in relatively sheltered water until you get the feel of it. There is a distinct difference in the way it handles, and the best way to learn the difference is to actually get some water under you and some wind in the sail. It won't take long to gain confidence. Happy sailing!

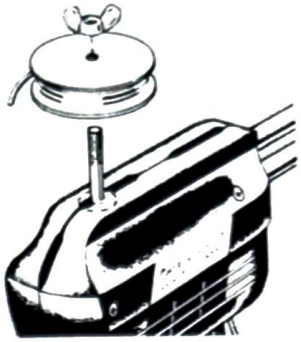
See also: bicycle boat; canoes; games, boating; kayaks; paddleboat; pontoon boat; sailboard; sailboat.



To make a square joint when bending angle iron, mark the axis, strike a line at right angles to show the thickness of the leg, scribe 45-deg. lines from the intersection and cut and bend the gap shut.

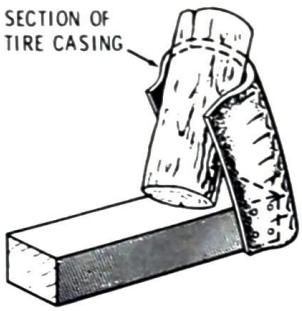


If you discover you are out of golf tees at the last moment, the concave caps from tooth-paste tubes make a good substitute.

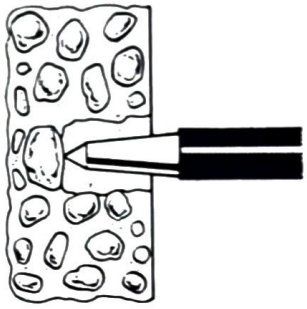


You'll always have solder handy if you wind it on a typewriter ribbon spool and mount it on the top of your soldering gun with a bolt and wing nut.

Keep your electric drill chuck key handy by clamping it in an alligator clip mounted on the drill.

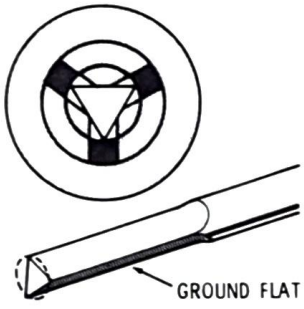


This splitting block made from a section of auto tire casing nailed to a 2 x 4 holds chunks of wood at just the right angle while you wield the axe.

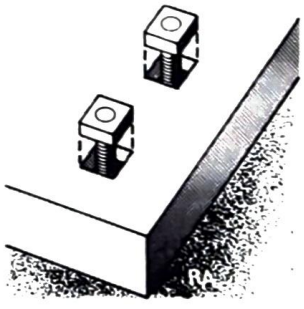


When drilling a hole in masonry and you hit a pebble, insert an old center punch in the hole and tap it with a hammer to split the stone.

To lock the trigger of a soldering gun in the "on" position, slip a heavy rubber band up over the handle.



You'll prevent your drill bit from slipping in the chuck if you grind the shaft to a triangular shape.



Use pre-positioned bolts recessed in your bench top to mount seldom-used tools, such as a pipe vise.

A master guide to caulking

An important part of your home maintenance work involves caulking cracks and seams. Here's everything you need to know about sealants to do the best and most efficient job

CAULKING IS ONE of the most important items of home maintenance. Good caulking cuts down cold-air seepage, cuts heating bills, and keeps water out of areas that must be kept dry.

Some caulking is applied to the exterior of the house, some to the interior. And while there are dozens of materials used as sealants, they break generally into three categories.

The first category is "regular" caulking compound, available in several varieties. This has been known and used for years, and when properly applied is effective and reliable.

The second category includes the newer compounds—the silicones, the butyls and others.

The third category is the newest of the "new"—the one and two-part polysulfide sealants, which give promise of lasting the life of the house.

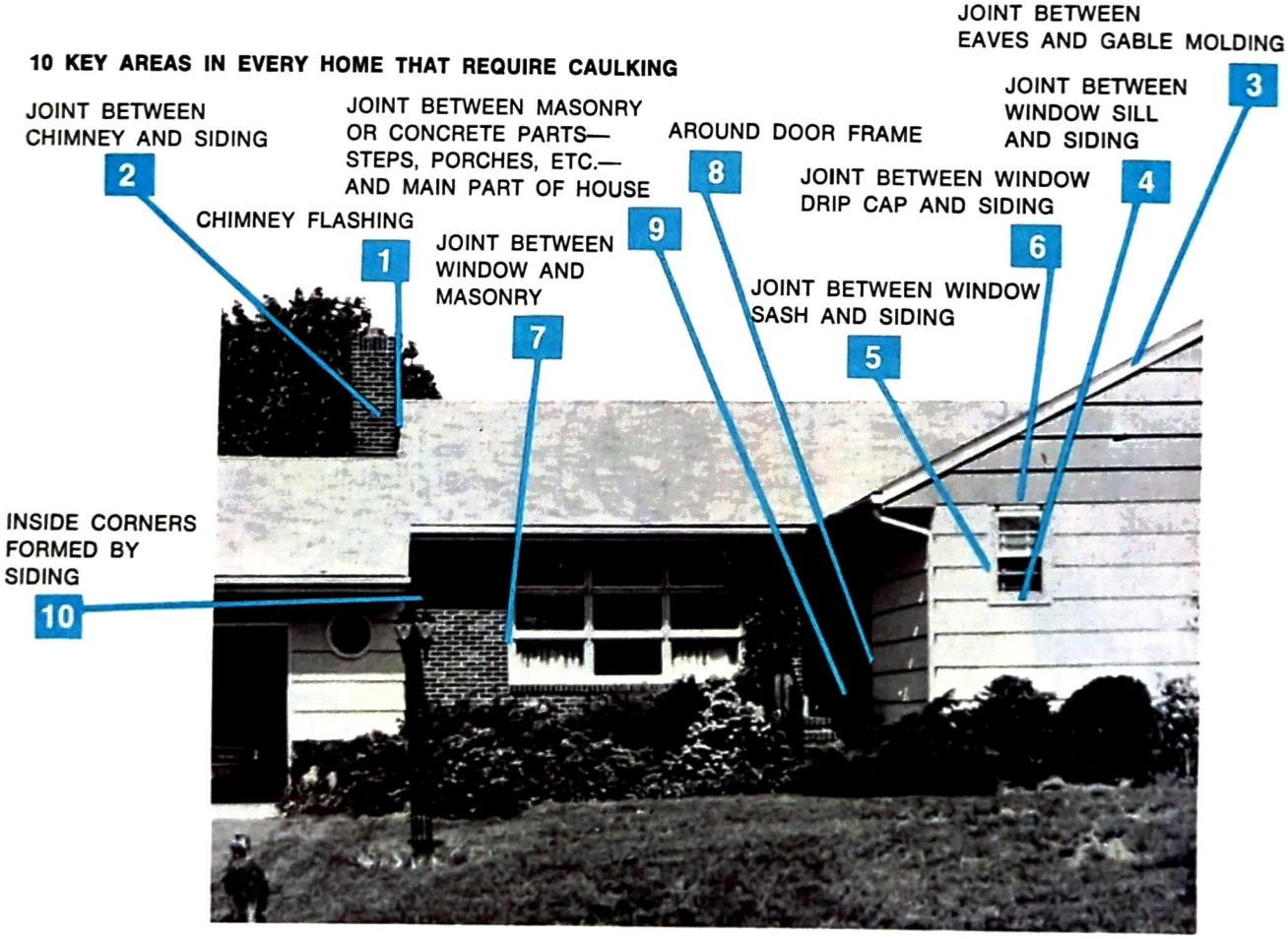
Here are the uses and applications of each of these categories of sealants.

REGULAR CAULKING COMPOUND is available in two general types, gun-grade and knife-grade, as well as some special types. Regular caulking compound should never be used inside a home, since it may not harden properly. Other materials, such as spackling, putty, patching paste or one of the new plastic sealers should be used to fill interior cracks.

The most widely used is gun-grade caulking, applied with a caulking gun. It is available in prepacked, nozzle-equipped cartridges and can be used to seal most cracks around the exterior of a home. As a rule, use gun-grade caulking for cracks no wider than the diameter of a pencil.

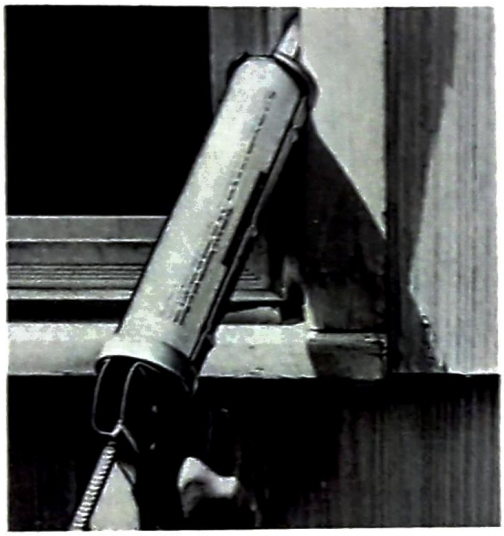
Simply insert the cartridge into a gun. A plunger in the gun is forced against the end of

10 KEY AREAS IN EVERY HOME THAT REQUIRE CAULKING



In preparing a crack for caulking, make sure it is clean. Rake out old dried caulking with a screwdriver or wood chisel

Finish the cleaning job with a good wire brushing. For assurance of adhesion, rub the area with turpentine-moistened cloth



Use aluminum caulking for sealing cracks around aluminum windows. No painting is needed since it contains aluminum pigment

A window apron which has pulled away from the sill should be renailed to the studs with finishing nails to prevent drafts

the tube, starting the flow of material. When pressure applied by the trigger is released, the flow stops. This type of caulking is available in white and gray, and can be painted.

Knife-grade caulking is used for sealing wider cracks—those larger than pencil-size. It is a stiff substance which must be applied with a putty or caulking knife, since it is too heavy to flow through a gun. Knife-grade caulking is flexible after it sets and does not disintegrate under the normal contraction and expansion of the adjacent wooden members.

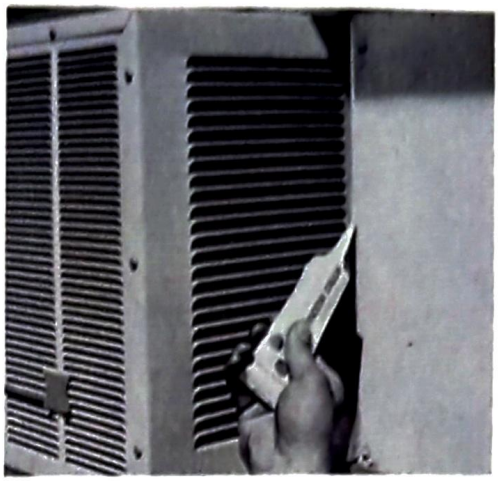
The only actual difference between gun-grade and knife-grade caulking compounds is that an asbestos fiber is added to the gun-grade to make it more flexible. Both types are made of natural and synthetic oils that keep them elastic and resilient.

Both compounds will adhere to most home building materials—wood, brick, stucco, stone and metal. For caulking around aluminum surfaces, use aluminum caulking compound because it doesn't have to be painted. It contains an aluminum pigment which lets the compound blend with the surface being sealed.

Another special type of caulking is "black" caulking. Designed for sealing cracks around and in roofs, it is basically an asphalt cement. You use it around flashings, vent pipes, to hold down roof shingles and to patch minor roof damage. It comes in cartridges and in small containers.

Cord-type caulking comes in rolls and is about

Replace window putty which has fallen away with glazing compound to seal out moisture

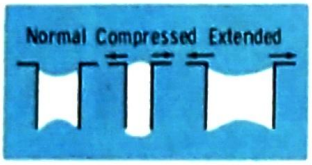


Silicone caulk absorbs vibration and allows for any movement at a joint between dissimilar materials, such as around this air conditioner

Prefilled cartridges make loading a caulking gun easy, and are discarded when empty

Squeeze the sealant into the widened groove between the batten and the window. Here, masking tape has been applied to the side of the batten, as in the sketch below, to simplify clean-up and leave a neater edge

r caulking guide, continued



Moving joints should be caulked with a slight dip in normal position, and not tooled flush. The seal shouldn't be much deeper than it is wide, and the bottom should be free to move as the sealant stretches

the size of cotton clothesline. It can be used for filling wide cracks which knife-grade caulking cannot seal. It is stripped from its roll and pressed into a crack with the fingers.

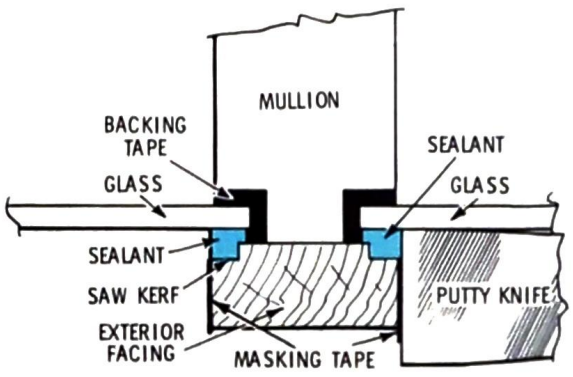
Another method of filling a deep, wide crack is to use a filler of oakum or steel wool in the bottom of the crack, topped off with knife-grade caulking compound.

In preparing for caulking, select a day during a dry spell in your area. The surface must be absolutely free of moisture, since most caulking compounds will not adhere to a damp area. (The only exception to this is black caulking, and it's a good point to keep in mind, since you can use this compound even when it is raining to seal a damaged and leaking roof area.)

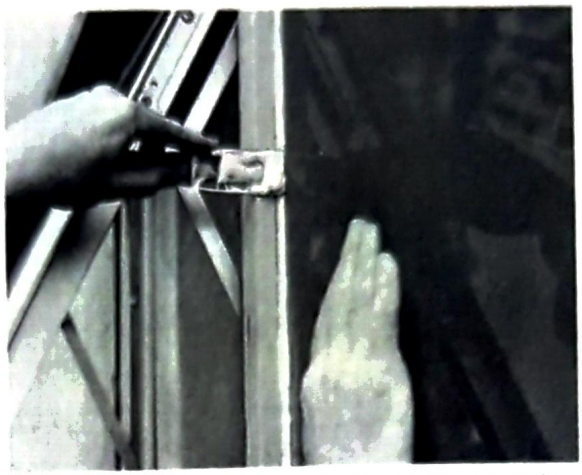
If there is old, dried caulking compound in the crack, dig it out with a wood chisel or an old

Where the batten (exterior facing strip) can be removed, saw off the edge of old putty to expose bare wood and to widen the groove. On new work, bed the glass in backing tape as indicated in sketch

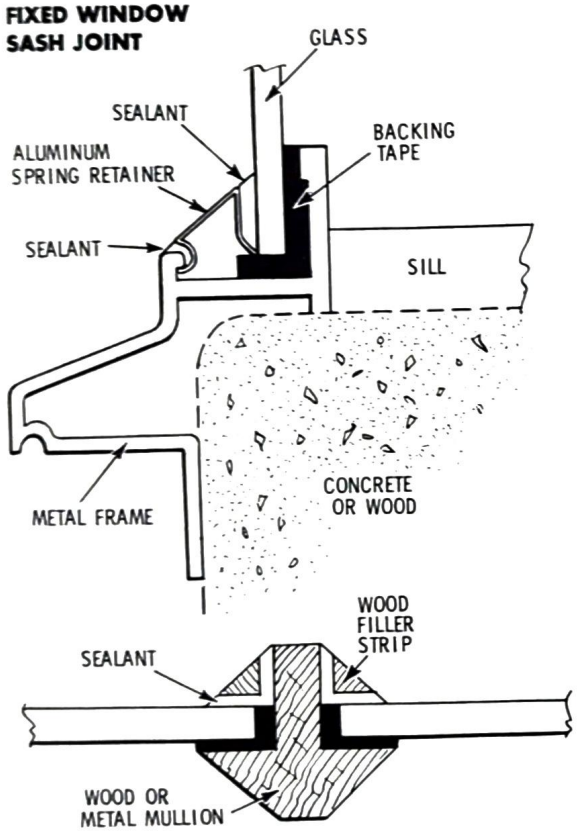
WOOD MULLION JOINT



Brush a thick soap solution over the bead of sealant before trimming, to keep the excess from sticking to the putty knife and the glass. Soak thin hand-soap shavings overnight in just enough water to thicken them into a paste. Use the solution on your hands, too



A putty knife trims excess sealant to leave a smooth square joint. Where a bevel is needed, trimming is more difficult and can be avoided by seating a triangular wood filler in the sealant, as sketched below, left. Top sketch shows how to seal an aluminum spring strip



FILLER STRIPS SAVE SEALANT

screwdriver. Brush out all particles of dirt and debris with a wire brush, and as added assurance for good adhesion, rub the area with a cloth moistened in turpentine or paint thinner. This will dissolve any grease or foreign matter not picked up by the brush.

A rule you should always follow is never to apply caulking to a porous surface, such as bare wood. Although the compound will stick, the wood soon draws all the oil from it and will leave it dry and crumbling. These porous areas should be primed with a primer, thinned linseed oil or a thinned quick-drying varnish. After the primer has dried, it's safe to caulk.

When it comes to actual application of caulking with a gun, one school advocates pulling the gun, while another states that the gun should be pushed. Handle the gun in whichever way is comfortable for you. It really doesn't matter.

Often, you may run across a hairline crack which seems insignificant. Should you caulk it? Absolutely! Water can seep into the house through this crack by capillary action. If the crack is too small for effective caulking, compound laid over it will soon pull away. In such cases it must be widened with a chisel to form a deep "V," so that compound has a surface upon which to get a good grip.

Caulking compound is relatively inexpensive, so use plenty of it to fill a crack. Too much compound in a crack provides a safety margin. If the compound shrinks, hardens, or crumbles a bit, or if the adjoining parts move, there will be enough compound left in the crack to compensate for the loss until you recaulk the area.

THE NEWER SEALANT COMPOUNDS can be used in both exterior and interior applications. Some are suited for specific jobs, others,

USES	MATERIAL	MANUFACTURE	TRADE NAMES	COLORS	CLEAN-UP SOLVENT	PRIMER
Tub-tile joint sealant, adhesive for tiles & metal fixtures, metal joint (plumbing, gutters) sealant, rubber sealant, auto & boat sealant, canvas	SILICONE Household & Auto	General Electric	Bathtub Seal Clear Seal Auto Seal Metal Seal	White Translucent Black Aluminum	Clean cloth will remove sealant if used immediately or dampen cloth with mineral spirits, naphtha, toluol or xylol	None
		Dow Corning (Silastic)	Bathtub Caulk Clear Sealer Metal Sealer Glass Caulk Aquarium Sealant	White Clear Gray Black Black		None
Seals dissimilar materials, as between wood & stone or brick, seals joints between fiberglass panels, skylights, ventilators, metal & concrete. Beds and seals flashing. Sets windows in frames, seals asbestos-cement panels, copings and wood gutters	Construction	General Electric	Construction Sealant	Translucent White Black Aluminum Neutral (stone)	Same as above	G.E. Metal Primer for aluminum, bronze, copper, stainless & galvanized steel. G.E. Masonry Primer for concrete, stone, unglazed tile & acrylic plastic
		Dow Corning	Dow Corning 780 Building Sealant	White Clear Black Gray Natural stone	Same as above	Dow Corning Surface Conditioner A is required on all surfaces except acrylics, which require Surface Condition C
Seals around windows, open siding or butt joints. Excellent for sealing flashings or for bonding loose shingles. Use to replace oil-base caulks or putty for up to 5 times expected life. Butyl sealants are useful in sealing dissimilar materials—glass, metal, plastics, wood, concrete	BUTYL RUBBER	Sonneborn Building Products, Inc. Sub. of De Soto Chemical Coatings	Butakauk	White Gray	Mineral spirits	None for most surfaces. Use Kurs-N-Seal as primer on highly porous or dusting surfaces. Use rust preventive primer on steel
		Pittsburgh Plate Glass Co.	Duribbon 4040 Non-Sag or Self-Leveling	Black Aluminum	Naphtha or a strong solution of Mr. Clean or Lestoil (1 to 1 mix with water). Clean up while sealant is fresh	None
		DAP, Inc.	DAP Butyl-Flex	Gray Natural white	Mineral spirits	None
		Pecora Chemical (6) Corp.	BC-158 Butyl Rubber Sealant	White Tan Brilliant white Gray Aluminum Stone Limestone Black Brown	Mineral spirits & naphtha	None
		The Gibson-Homans Co.	Eternaflex Butyl (skinning type) (nonskinning type)		Same as above	None
		The 3M Co.	Weatherban 202 Butyl Sealant	Off-white Gray Aluminum	Same as above	None
General sealing and caulking in building construction at any location where oil-base caulks were formerly used. Hypalon†-base caulks are one-part sealants with almost unlimited weatherability and an unlimited choice of bright, fast colors	HYPALON† (Chlorosulfonated Polyethylene)	West Chester Chemical Co.	Maintz Architectural Caulking Compound	Black Gray White Any special color @ 25¢/gal. extra	Xylene Tolunene	None
		Gates Engineering Co.	GACO H-88	Gray	GACO N-450-1 (Xylene)	None
		The Gibson-Homans Co.	Eternaflex One Component Hypalon† Sealant	White Gray Special colors	Xylol Toluol	None
Particularly useful in sealing metal joints, such as flanged sheet metal, gutters and mechanical parts. One-component sealant	NEOPRENE†	Gates Engineering Co.	GACO N-99 Neoprene Sealing Compound	Off-white	GACO N-450-1 (Xylene)	None
Glazing, general construction sealant. Applies directly from cartridges. Particularly adapted to narrow cracks. Combines the elasticity of Neoprene† with excellent weather resistance of Hypalon†	NEOPRENE†-HYPALON† Combination †TM—E. I. duPont de Nemours & Co.	Tufcrete Co.	Tufcrete Elastomeric Sealant	White Gray	Xylol Toluol	None
Interior sealing joints around tub and shower, fills cracks in tile, plaster, glass and plastic, sink, counter tops. Fills nail holes and seals window joints around windows and storm sash	LATEX	The Cambridge Tile Mfg. Co.	Cam Calk	White	Water	None
		The Borden Chemical Co.	Mystik Tub Caulk	White	Water	None
(Same as above)	LATEX (Polyvinyle Acetate Copolymer Latex)	DAP, Inc.	Kwik-Seal	White	Water	None
Multipurpose adhesive and caulk for boat and home use. Fills areas like a wood putty; can be sanded smooth. Fills holes for seating expansion bolts, prevents nuts from loosening; patches canvas, leaks in metal containers and seals joints in buildings and boats	MISCELLANEOUS Reclaim Rubber & Caulk	Miracle Adhesives Corp.	Miracle Black Magic	Black	Mineral spirits Toluol	None
Replaces filled linseed oil for general around-the-house caulking jobs	Unknown Material	Sears, Roebuck & Co., Stores & Catalog	5-Year Guarantee Sealer-Caulk	White	Mineral spirits	None
Thin seam sealing in metal joints, but also adaptable for porous and nonporous construction materials, including glass. Can be applied at low temperatures. Useful in sealing metal buildings, downspouts and gutters	Nitrite Rubber	The Goodyear Tire & Rubber Co.	Pliogrip Seam Sealer Self-Leveling Sealant Sealing Compound	Aluminum	Methyl ethyl ketone	None
Roof repairs, coarse caulking at any interface with tar or asphalt material, such as blacktop driveway or roofing	Chemically Processed Asphalt Base	DAP, Inc.	DAP Black-Tite	Black	Mineral spirits Naphtha	None
Caulking inside and outside, particularly with latex (water-thinned) paints. Also, a useful caulk with alkyd or oil-based paints	Acrylic Latex Emulsion	DAP, Inc.	DAP Latex Caulk	Bright white	Water	None

CURE METHOD	CURED HARDNESS*	SHRINKAGE	ADHESION	REMARKS
Absorbs moisture from air Non-tacky—1 hour Full cure—10 days	25–30	Nil	Good	Readily available in hardware and department stores. If color is not important, use translucent silicone sealant. All are highly versatile household silicone sealants; not recommended in sidewalk joints or with porcelain steel. Flexibility of cured silicone rubber allows stretch of joints up to 3 times normal width or compression to ½ width. Silicone sealants extrude easily
Reacts with moisture vapor from air Non-tacky—1 hour Full cure—24 hours Max. properties—7 days	25	Nil	Good	
Same as above	35	1–3%	Good	Silicone construction sealants remain flexible for life after curing; thus can stretch or compress as building or joints move with setting or temperature changes. Silicones will stick to paintd surfaces, but paint will not adhere to cured silicone. If bonded to paint, joint may fail if paint bond fails. Best joint bonding is directly between silicone sealant and base material. Best joint dimension is ¼ x ¼ to ¾ x ⅜". Fill deep joints with polyethylene foam. Tool or trim joints within 10–15 minutes and remove any masking tape before joint surface begins to develop skin. Do not use construction sealants in joints continuously under water
Same as above	25	Nil	Good to excellent, depending on base material	
Solvent release	25–35	5–10%	Good	Butyl rubber base caulks are somewhat less resilient than cured silicone or polysulfide rubber but offer considerable improvement over oil-base caulks for general house & building construction. Butyl rubber caulks allow for joint movement and do not become brittle with age. Butyl particularly useful for thin beading or needlepoint caulking
Solvent release	0–10	Approx. 30%	Good	Use the self-leveling type only for horizontal seams. Shrinkage greater for self-leveling type than for nonsag. Seal is effective immediately and remains flexible while solvent escapes
Air dry	10–15	10–15%	Good	Butyl caulk may be painted over after skin is formed and seal is set—up to 7 days, depending on weather. Apply only when temperatures are above 40° F.
Solvent release		5–10%	Good	
Solvent release	0	15–20%	Good	Use nonskinning (uncurling) type where sealer will not be exposed to outdoor elements. Limit joint width to ⅜" max.
Solvent release		15–20%	Good	Butyl sealant adapted to fabrication joints where total movement is limited. Can be used as a backup sealer for large seams and for caulking applications where high resiliency and quick recovery are not critical requirements.
Solvent release	20	3–10%	Excellent	Hypalon†-base caulking compounds are the most easily colored, and special colors are easily obtainable. Ultraviolet radiation resistance is excellent, and cured seals remain rubbery and resilient for an almost unlimited time. Adhesion is excellent. Curing time is up to 60 days, depending on weather; therefore, do not stress joints during the first 1 or 2 months, even though surface appears skinned over solidly. Can be painted over after joints are cured. To assure best adhesion, press bead of caulking to surface for full contact. Apply only when temperatures are 50° F. or higher; otherwise, warm caulking to 70° F. in heated area
Solvent release	25–30	10%	Excellent	
Solvent release	25	14%	Excellent	
Solvent release & internal cure	10	5–8%	Excellent	Cures very slowly—up to several months required for complete cure. Remains permanently elastic. Not adapted for continuous immersion in fresh or salt water
Solvent release & internal cure	20	15%	Excellent	Cures slowly—60–120 days after application although dry to touch after 24–48 hours. Only fair resistance to oil. Can be painted when surface loses tack
Solvent release & air reaction		5–10%	Excellent	Easy caulks to use because they are water-thinned during application. Seams can be trimmed and smoothed with moist finger or damp tool. Later material develops water resistance when dry. Latex caulks can be sanded and painted. Less resilient and elastic when cured than synthetic rubber materials. Material washes easily from tools and hands for easy clean-up with plain water
Solvent release & air reaction		5–10%	Good	
Solvent release & air reaction	40–60	5–10%	Excellent	Easy caulk to use because of its soft buttery consistency. Seams can be trimmed and smoothed with moist finger or damp tool. Caulk develops water resistance when dry. Latex caulks can be sanded and painted but are less resilient and elastic when cured than synthetic rubber materials. Latex caulk washes easily from tools and hands with water
Solvent release		10–20%	Excellent	Versatile combination caulking compound and adhesive. Adapted for adhering flashing or other material to damp surfaces. Use only where black color is not objectionable or is to be painted over. Cured Black Magic can be sanded to a feather edge and painted
				Five-year guarantee indicates obvious improvement over oil-base caulk. Exact material base not known
Solvent release	74–80	10–30%	Good	All 3 products by Goodyear carry the Pliogrip trademark. Seam Sealer is a free-flowing paste for sealing seams on aluminum gutters, downspouts, storm doors and other metal joints. Use on seams no wider than ⅛ in. Self-leveling Sealant flows readily and should be used only on horizontal joints in wood, metal and masonry Sealing Compound is a nonsag caulk for vertical or horizontal joints in windows and flashing Allow at least 30 days before painting
Solvent release	50–60	5–10%	Fair	Asphalt sealant is not a conventional caulking material. It can be painted over by using 2 coats of oil-base paint. Asphalt-base tube caulking useful mainly for plugging roof leaks and for caulking edges of roofing, bedding flashing or filling cracks around drains
Air-dry & self coalescence	50–60	10–15%	Excellent	DAP Latex Caulk developed specifically for use under or over latex paints. It will not bleed, blush or stain. When painted with latex paint, DAP Latex Caulk actually merges with paint film to help prevent peeling

* Rubber hardness on Shore Durometer A Scale hardness of rubber in a baby bottle nipple.

such as silicone rubber, can be used to solve a number of different problems. This is where cost should be considered. Why use a high-cost sealant if a lower-cost material will do just as well?

use chart for selection

Look at the chart on pages 566 and 567 to locate specific information about uses, brand names and properties of these sealants. Select the sealant you need first from the "Uses" column. Here is a rundown of the characteristics of each type:

SILICONES. Among the most useful and generally available one-part sealants are silicone rubber materials. Normally translucent, these sealants can be colored with pigments that don't migrate during curing. Three general types are available—*General Purpose*, for use around the house; *Construction*, used primarily in the construction trades for sealing wood, metal and concrete seams and joints; and *Marine*, for both above- and below-waterline use on boats. To assure the best adhesion, primers are required on certain materials.

Silicone rubber sealants cure by absorbing moisture from the air. Normally, the surface will skin over in 15 to 30 minutes, depending on air temperature and humidity. A full cure to an elastic seal requires at least 7 days. Cured silicone rubber is particularly resistant to soiling because little dirt will adhere to it. However, this property also prevents it from accepting any paint after curing, so make sure that you finish painting before applying this type of sealant.

Ordinarily, joints can be smoothed or trimmed with a damp finger, wood stick or other tool, but do this within a few minutes after squeezing the caulk into a seam before the surface begins to skin over.

Partially cured silicone sealants can be removed from joints or tools with xylene or toluene solvents. When fully cured, however, they must be carved off with a razor blade.

Adhesion of silicone sealants is good—so good, in fact, that they can be used as adhesives, particularly where a watertight joint is required (though they are not recommended for use in concrete or tile-lined swimming pools). They are relatively expensive but, where small quantities are required and top performance is desired, there is little to compare with them.

One precaution: Do not use silicones on any asphaltic material, oil impregnated wood or any other material that may bleed oil or solvents.

BUTYL. A step above regular filled, linseed-oil caulks (and slightly more expensive) are sealants based on butyl rubber. Butyl-rubber caulks skin over in the same way that oil-base caulks do. However, even the skin remains rubbery, stretching and compressing as the parts of the joint move. In general, butyl-rubber caulks can be expected to last from two to five times as long as oil-base caulking. When using butyl, though, remember that it has a relatively high shrinkage rate—up to 35 percent.

HYPALON. A DuPont synthetic, Hypalon is formulated into sealants primarily for construction use. It's easily colored, and special colors to match marble or other materials can be ordered.

Hypalon-base sealants are among the most weather-resistant available, with almost complete resistance to ultraviolet radiation. (Hypalon-base coatings, for example, are used over thin-shell concrete roofs.) Since these are specialty sealants used mainly in construction, they are not generally available through local hardware stores, though most large building supply dealers carry them.

Hypalon cures slowly

Hypalon cures slowly and is easily damaged until fully cured. It's not recommended for sealing joints in walkways where women's sharp heels may penetrate.

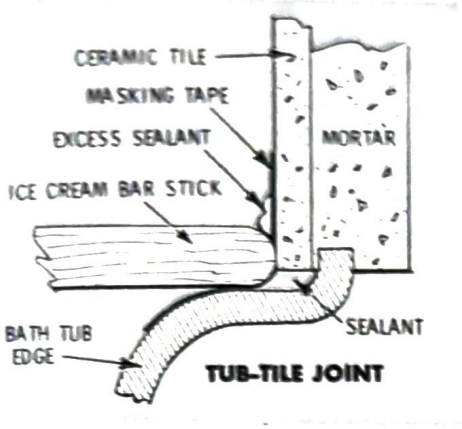
NEOPRENE. Another of DuPont's synthetic rubbers, Neoprene offers exceptional elasticity and softness when cured, making it ideal for sealing small seams and sheet-metal duct work.

Neoprene sealants cure very slowly, taking up to 60 days for a full cure. In the meantime, they can be damaged easily. Neoprene is often mixed with Hypalon to form an elastomeric sealant which combines the excellent weathering properties and color of Hypalon with the elasticity and adhesion of Neoprene. Combination Hypalon-Neoprene sealants are often used for sealing soft stone to prevent tough sealants from pulling loose a surface layer of the stone.

LATEX. Formulated somewhat like rubber-base paints, latex caulks are easy to use and relatively inexpensive. Some brands are packaged in aerosol containers; others are sold in small tubes.

Latex caulks are designed primarily for interior sealing around bathtubs, showers and sinks. They remain flexible, and unlike oil-base caulks, will not crack, chalk or crumble. Because plain water can be used as a solvent, trimming and clean-up are easy.

MISCELLANEOUS. A surprising number of other materials are available for caulking and



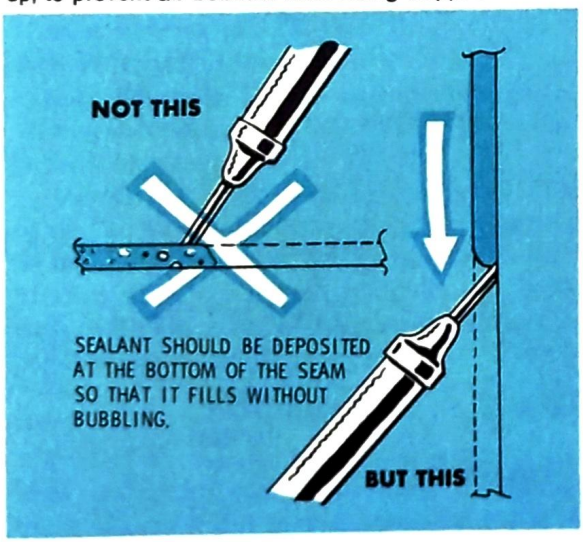
Cross-section of a tub-to-tile joint shows how the sealant extrudes into the space for a watertight seal. Stick leaves a flush joint

After removing the cracked grout between the tub and the tile, clean with a solvent-soaked cloth wrapped around the blade of a putty knife

Simplify clean-up by applying masking tape to both the bath tub and the tile. Trim the plastic nozzle of the disposable tube at an angle

After trimming with a stick as shown in sketch above, left, pull up the masking tape. Excess sealant comes up with it, leaving a smooth joint

The gun nozzle should be small enough to reach into the groove to fill it from the bottom up, to prevent air bubbles from being trapped



sealing. Rubber, asphalt, nitrile rubber and certain plastic polymers are formulated for application with a caulking gun. These plastics usually cure to a flexible sealant by releasing solvent or by contact with air.

Some sealants are designed to remain permanently tacky. PR-615 and nonskinning butyl rubber, for example, are sealants that permit unsealing and resealing without fuss. A hatch cover on a boat can be sealed watertight with PR-615, yet if it must be removed, the sealant will part without tearing. To reseal, simply press the cover back into place again. The only problem is to keep from touching the sealant while the joint is apart. PR-615 sealant will stick tenaciously to almost anything, particularly fingers.

POLYSULFIDE SEALANTS, newest of the new, let you seal water out of almost every joint around your home—inside as well as out. And they're a boon to boat owners, too. Here are some of the things you can do with the sealers:

- Put a permanent white or colored sealant joint

between the bathtub or shower stall and ceramic tile or plastic-surfaced wall panels.

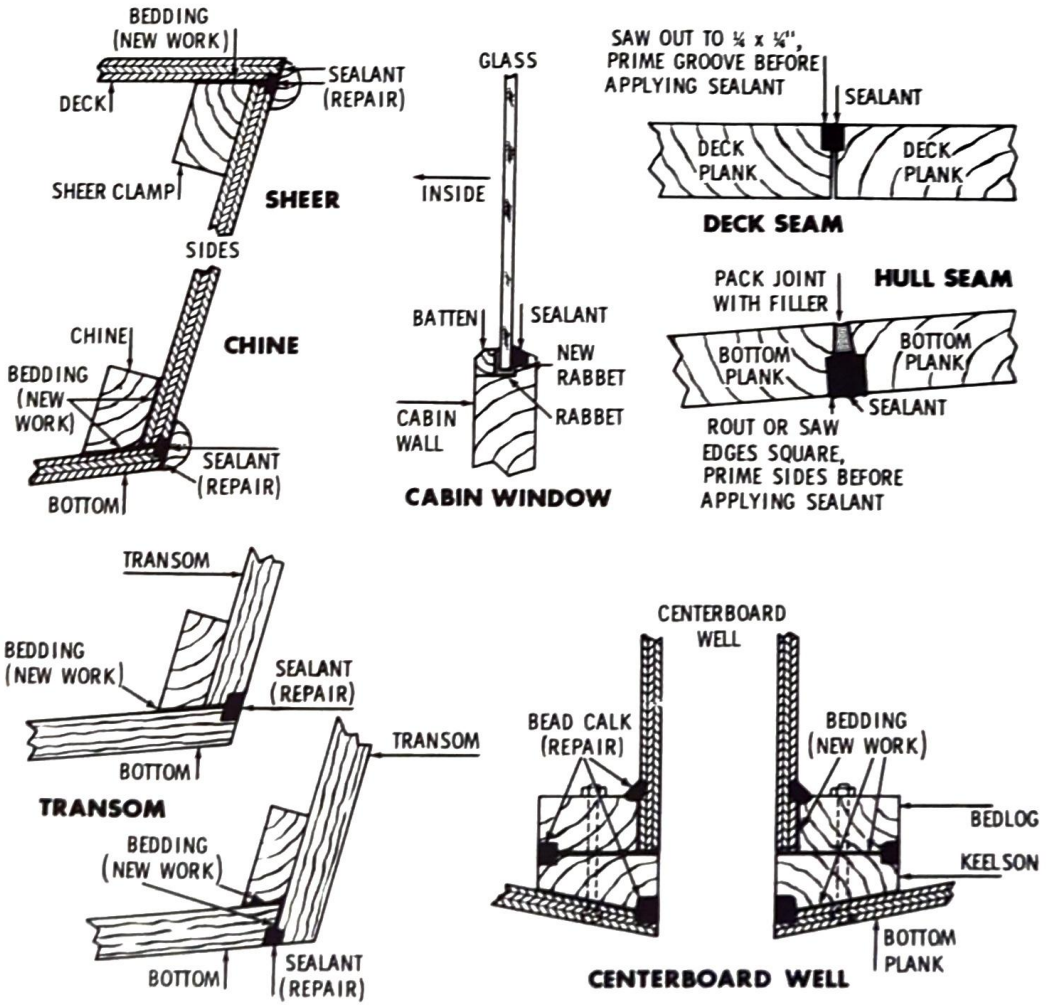
- Bed a kitchen sink or washbowl to eliminate the metal rim that often interferes with drainage.
- Butt-join wooden gutter sections with a permanent seal that moves as the gutter expands and contracts. And you can seal slip joints between metal gutter sections.
- Seal window panes, door glazing and window frames.
- Make butt joints between panels or strips of wood siding, batten joints without flashing, and seal joints between siding and door or window frames against water that often causes paint peeling.
- Seal joints between dissimilar materials such as wood siding and a chimney, concrete walks and a house, etc.
- Make boat seams and joints watertight.
- Seal concrete, brick and stone joints without fear that alkali from the cement will destroy the bond.
- Seal cracks in foundation walls or between concrete blocks, to keep out water.

Rubber sealants will do a good repair job for several reasons: There is no shrinkage or cracking and the joint remains flexible. The rubber sealant will last as long as your house, remaining flexible from 65 deg. F. below zero to 250 deg. F. Accelerated aging tests show no change in characteristics after 50 years of weathering.

Rubber sealants adhere to almost any material, and usually the material repaired will break before the rubber lets go. And they can maintain their original seal when stretched to three times their original width—which means more than enough flexibility for any household seam.

You can keep your boat dry by using rubber

Below are sketches showing the use of polysulfide sealants in repairing boats and in new boat construction. In new work, assemble the parts to check the fit first, then disassemble the parts and coat the surfaces with primer. Finally apply enough of the sealant so that a little will be squeezed out when the joint is assembled



sealant in the seams—particularly hard-to-seal joints around the centerboard well or transom.

Older formations of polysulfide rubber required mixing two parts together before use. The newer material comes ready for use in bulk or in disposable cartons. These sealants cure by absorbing water from the air. Normally, the sealant will skin over in 24 hrs. and is tough enough to withstand some abuse in 48 hrs. But it does not reach a full cure for 60 days.

You can speed up the cure if necessary by keeping a moist towel over the seam after it has skinned over, or you can apply methyl ketone (MEK) or isopropyl alcohol to the surface.

Synthetic rubber sealants are costly, and considerably more expensive than oil-base caulking or putty. They may cost up to three times as much as marine caulking. But there are two times when you can use them economically: First, when no other material will do the job (hull planks or deck boards on a boat can be repaired with sealant without being ripped out); and second, where the long life of rubber sealant saves frequent replacement of old-style caulking.

As in painting, the biggest cost in reglazing or recaulking is the labor cost for preparing the joints.

Rubber sealants must be applied to clean wood. Rubber caulking will not stick permanently to old oil-base caulk, paint or any oily surface. Wood preservative applied to prevent rot in boats will not interfere with a rubber sealant joint, providing the spirit solvents are allowed to dry out thoroughly before the rubber sealant is applied.

On some materials and under some conditions, a primer will improve the sealant joint. Normally, a primer is not necessary for house caulking because the joints will not be immersed in water continuously, nor are they under pressure. When you do use a primer, always be sure to use one made by the manufacturer of the sealant; otherwise, the caulking and the sealant may not be compatible.

Primers are liquid and can be applied like paint. Use a small brush to control the coverage, let the first coat dry about an hour at room temperature, then apply a second coat. Allow the two coats to cure for 24 hrs., longer if the temperatures are below 70 deg.

use primer on brick

Primers should also be used on concrete, tile, brick and other porous materials to improve the seal. Since primers turn brown on exposure to sunlight and are difficult to remove, be careful to keep your application within the joint area.

Loose dust, old caulking material, oily or bituminous residue of any kind, or other coatings on a surface, can prevent polysulfide rubber sealants from bonding tightly. But since the rubber sealant will last for life if put on right the first time, you can afford to spend more time cleaning and preparing the surface.

Joints around a house should be about ¼ in. deep by ¼ in. wide. Seams on boats or at locations around the house that may move more than about ⅛ in. should be wider. A rule of thumb for figuring joint widths is to multiply the expected joint movement by three. For example, if a joint between the wood framing and the fireplace is ⅛ in. wider in the winter than in summer, make the joint at least ⅜ in. wide. If the joint is already ⅜ in. or more wide, stuff flexible tubing or closed-cell sponge of vinyl or rubber into the joint until the space left for the sealant is just as deep as the width, or ⅜ in. deep for this example.

When replacing old, aged caulk or putty on an outside seam, there's no problem with oil from the old material soaking into wood and loosening the seal between the rubber sealant and the wood. However, on new window installations or if an entire window is replaced, the use of putty to bed the panes might affect adhesion. So, instead of putty for bedding, use one of the backing tapes available for each type of sealant. Sketches on pages 564–5 detail how the dry side and edges of the glass rest in the tapes.

Small-pane windows normally installed with putty chamfered to a 45-deg. angle can be installed with polysulfide sealant, but use a large quantity of the material, and trimming the sealant to an even angle requires considerable skill. For deep fillets of sealant, a triangular wood filler, seated in sealant as sketched on page 565, simplifies getting an even trim and reduces the quantity of sealant required. Just apply a bead of sealant to a clean corner, press the filler strip into it and trim away squeezed-out sealant. Miter the ends of the filler pieces and fit them to openings before applying sealant.

remove all old oil

The easiest way to remove all old oil, caked caulking or paint is to saw a slight kerf along the rear edges of window battens as sketched on page 564. When the batten or other facing strip cannot be taken off easily, remove all of the old putty with a beer-can-opener or linoleum knife. As a final step, shave off a thin layer of wood

with a utility knife or chisel. When caulking a batten around a house or boat window, leave a space at each end to fill with sealant. Remove any paint or finish down to bare wood from the space opposite the batten end for a good seal between these members.

Once the joint surfaces are cleaned (and primed if necessary), applying the sealant is similar to the application of any caulking material. However, because the polysulfide rubber sealants cure chemically, the sealant is more fluid and is easier to work. In fact, one of the big bonuses when caulking boat seams is the ease and rapidity of squeezing in rubber sealant.

One hint about cleaning up. Polysulfide rubber sealants are plenty sticky, and they will cling to your skin with the same tenacity as to wood and stone. So, before starting to use the sealants, rub several layers of thick soapy paste on your hands or wear gloves. You'll need this paste anyway in trimming the sealant.

Polysulfide rubber sealants are available in sealed cardboard tubes that fit into a standard tube caulking gun. Polyethylene tubes, on the other hand, must be used with special hand- or air-operated guns. Once emptied, the polyethylene tubes can be cleaned and reused. Cured sealant can be rubbed off these tubes like rubber cement off paper.

Plastic nozzles screw into the ends of the plastic tubes. By cutting off the end of the nozzle at an angle, you can control the flow of sealant into the groove. The end of the nozzle should be small enough to reach the bottom of the seam so the sealant can be deposited from the bottom up. Don't worry about an uneven surface on top while squeezing in the sealant, as the surface will be smoothed and trimmed later.

smooth with putty knife

On a flat seam, smoothing can be done simply by drawing a putty knife over the surface and forcing the sealant into the seam. Any sealant that spreads to either side of the seam comes off with the masking tape to leave a smooth, even joint. Since there is negligible shrinkage with the rubber sealant, no excess material need be left for trimming later. If any excess sealant remains after curing, it can be sliced off with a razor blade or sanded flush with the surface.

Around windows, brush the surface of the sealant bead with your soap paste before trimming, then shape the bead into a smooth, even seam that is parallel with the batten face on vertical joints and is slightly angled along horizontal ledges. The slope will allow water to drain off the joint after running down the window.

On joints ⅜ in. and wider, make two or more passes with the gun to fill in the space. Succeeding layers of the rubber sealant will bond perfectly to previous beads.

Cured seams of rubber sealant can be patched or expanded easily by first trimming away any excess sealant. New rubber sealant is then squeezed into the seam where it bonds onto the cured rubber. Bubbles or voids that show up after curing can be cut out and patched.

Polysulfide sealants have been used with great success in marine applications, both for bedding frame members and for caulking seams.

Due to their consistency, these synthetic rubber sealants flow into every void in a bedding joint, filling irregularities that could turn into leaks later. And since there's practically no shrinkage during curing, these stay filled.

In bedding, first assemble the joint dry to check fit, then disassemble the parts and coat both surfaces with primer. Once the primer has dried, apply enough compound so a little will be squeezed out when the joint is assembled.

use a caulking gun

If the joint covers only a small area, you can butter the sealant on with a putty knife, but for large areas it's much easier to apply a bead with a caulking gun. Then reassemble the joints and knife away the excess sealant squeezed out.

Wood preservatives won't interfere with bonding, but if penta or copper-bearing preservatives are used, allow time for the mineral-spirit solvents to evaporate before applying primer. The joint can be painted after curing, but remember that the sealant will stretch or compress as necessary, and movement may cause paint to flake off where the sealant flexes.

When caulking seams, try to keep the sealant-joint cross section approximately square. Rout out soft or decayed wood and remove all remains of old caulking before applying primer. Minimize clean-up by masking both sides of the joint.

Horizontal seams can be filled with a flow-type sealant, which has a consistency much like thick paint. This is a two-part formulation requiring that an accelerator be mixed with the base material. The same surface preparation is required. After mixing, simply pour the sealant into the seam. It must be used within 2 to 4 hrs. after mixing. Any not used should be discarded.

Photo courtesy National Gypsum Co.

Use this paneled ceiling anywhere in the home. Notice in this installation how the grid complements the wall treatment. Luminous panels permit installation of indirect lighting

Make the ceilings fit into the room decor of your home—something more than a flat expanse of plaster. With ceiling tile it's one of the easiest of all do-it-yourself projects

What you should know about ceiling tile

BY W. CLYDE LAMMEY

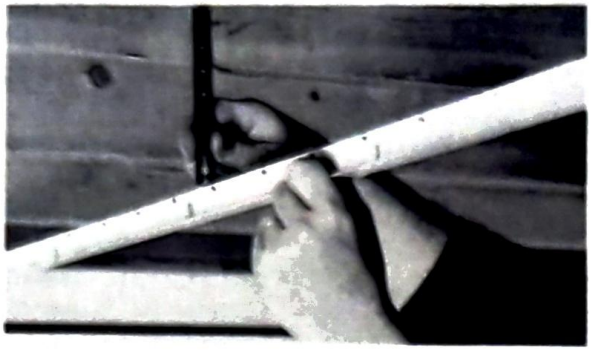
DO THE JOB one day—show it off the next. New tile ceilings are as simple as that. No paint rolling, no special fuss and the minimum of messing up the place. When you're finished, about 4:00 P.M., just pick up the waste pieces, take out the ladder and run the vacuum over the floor, or maybe the rug. Slide the furnishings back into place and that's it.

Ceiling tile come in just about any color, size and pattern that catches your eye from plain to extra fancy. And you stick 'em, staple 'em, or hang 'em to or from almost any existing ceiling, high, low or in-between. If there's a ceiling over your head—open joists, plaster or even plasterboard—tiling it is no problem.

If you live in one of those solid older homes where plastered ceilings are beginning to look a little dingy even after fresh painting, or have begun to sag a little with the weight of the years, you can "redate" the whole interior with ceiling tiles. If existing ceilings are way up there 9 or 10 ft. from the floor you may want to reproportion rooms to more modern height dimensions. It's easy to do with a suspended ceiling having luminous panels for soft, indirect lighting.

Procedures are determined mainly by the type of panels or ceiling tile you plan to use. If floor

cells, dry: see batteries, dry cell
cements: see glues
centering: see lathe techniques
centerpiece: see Christmas decorations
central airconditioning: see airconditioners



On open ceilings special hangers attached to joists suspend metal Tees and cross Tees of the grid system that supports the panels

Cross Tees "snap" into place on long Tees, forming a grid of the correct module. Handle parts with care to avoid damage before and during installation

Photo courtesty National Gypsum Co.

joists are exposed, as in a basement, or ceiling joists are exposed as on the first or second floors of some older homes, you will need at least 3 in. clearance for a suspended ceiling, either below the joists or below any obstructions such as ducts or pipes. Of course, clearances are not involved if tile are to be attached directly to a plastered ceiling by adhesive or furring strips.

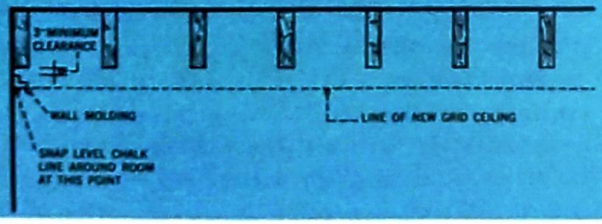
Either way select the tiles or panels first and then do a bit of planning. If you are working in an older home and plan a suspended ceiling which will lower ceiling height from, say, 9 ft. to 8 ft., or perhaps 10 ft. to 8 or 8½ ft., check the distances from the top of window and door trim to the existing ceiling. For best appearance in average rooms in older homes the new suspended ceiling should not be less than 6 in. and better, 1 ft. above the trim. Snap a leveled chalk line around the room.

Then obtain a gridded paper worksheet (it's available from most building materials dealers) and draw an outline of the room on which you show the location and spacing of the horizontal metal Tees and cross Tees which form the grid support for the new ceiling panels. Also you mark on the outline the location of any bays, soffits, alcoves or any other room details that may affect placement of the supporting grid and panels. If there is to be indirect lighting, the lights directly above luminous panels, then the fixtures should be installed in the proper locations beforehand. With the outline made you then determine grid materials needed.

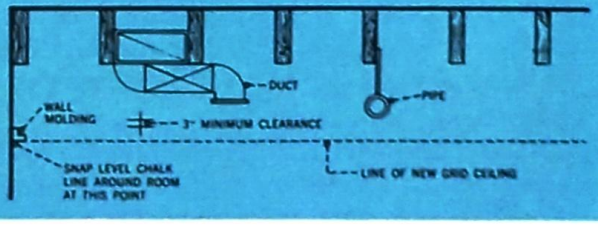
Finally you attach the wall molding which supports the outside edges of the panels at the chalk-marked ceiling height. Then install the metal grids, both the mains and crossmembers. This done you drop the panels on the supporting grid members and there you are.

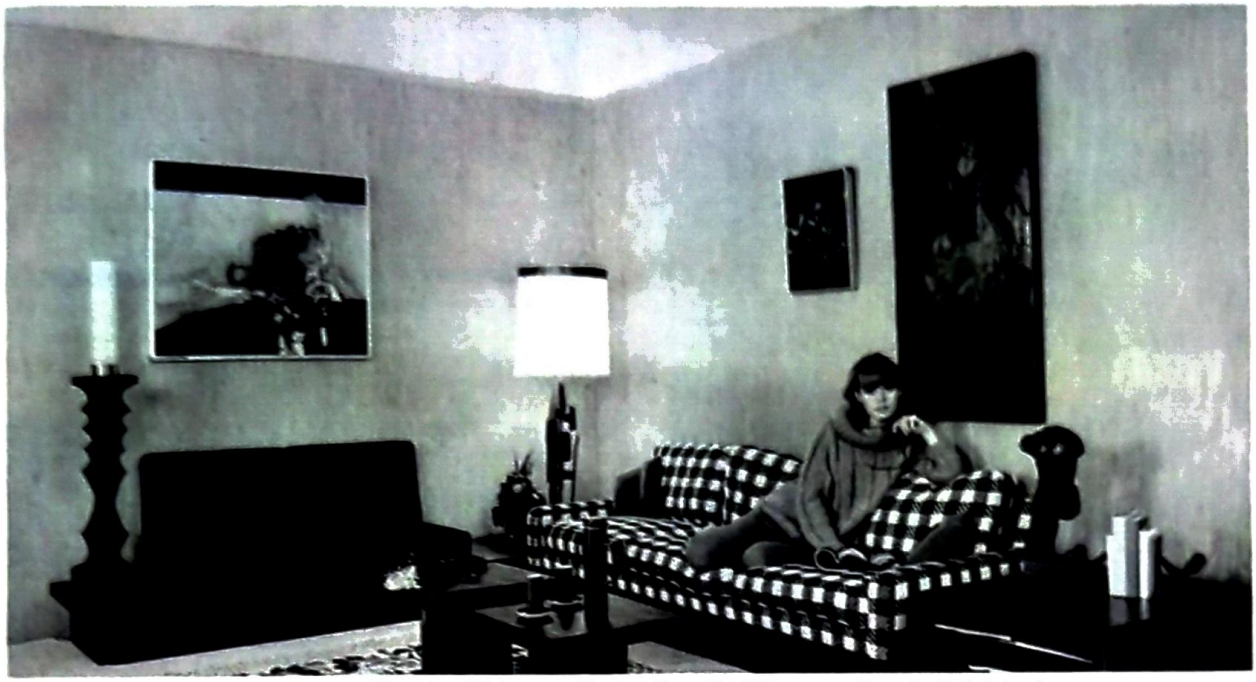
Left, all that remains after installing the grid is to slip the panels into place and there's your new ceiling. Below left, you'll need at least 3-in. clearance below the joists where there are no ducts or pipes. If there are ducts, pipes or other obstructions, allow at least 3 in. below these

LOCATING CEILING HEIGHT—EXPOSED JOISTS



LOCATING CEILING HEIGHT—OBSTRUCTED AREA





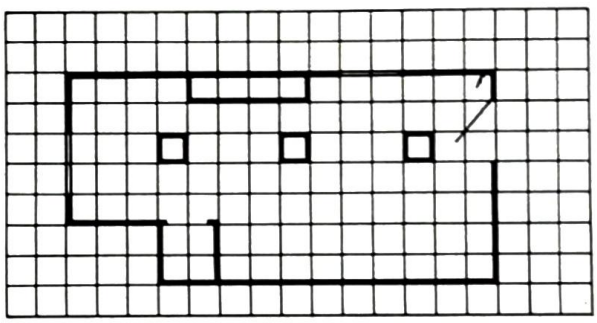
Try to picture this room without ceiling tile. Without a tiled ceiling it's little more than half finished

Should you decide on tiling the ceiling rather than using panels you have a choice of two common methods of installation: either nail or staple the tiles to wood furring strips, a common procedure where ceiling joists are exposed; or adhesive application of the tiles directly to old but sound plaster or plasterboard. Also in some instances ceiling tile are stapled or nailed to boarded ceilings where boards are no wider than 4 to 6 in. with no cupping or offset joints.

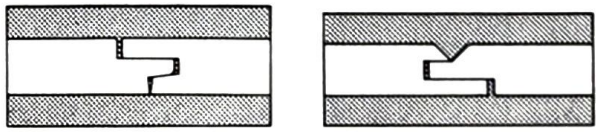
In any case make sure the boards are solidly nailed to the joists and try to plan placement of the tiles so that no staples or nails through the tile hit cracks between the boards.

There are two common types of ceiling tiles, one having the tongue and groove cut so that the meeting edges butt, forming a flush joint on the face, or down side. The other type, which is perhaps the most commonly installed in homes, has the exposed edges of the individual tiles cut at an angle so that when installed the joints form Vees. Either way you get a most attractive and durable ceiling job.

There are two steps to check out closely when you install ceiling tile over wood furring: Draw the plan on grid paper scaled to the size tiles you are to use so that you can calculate how many tiles are needed and locate the furring strips so that tiles join squarely on the center of each. Then, before you apply the furring strips, check the "level" of the joists with a straightedge. In any open ceiling you are almost sure to find at least one joist that extends downward from ¼ to ½ in. more than the others. This one, or more as the case may be, must be trimmed flush, either with a plane or with a hatchet if you're handy with this tool. Just be sure those joists are all flush before you nail up the furring.



First step is to decide on the tile or panels you want. Then sketch a plan of the room on gridded paper. From this you can determine number of tiles needed



Two common types of ceiling tile are available. Each comes with a tongue-and-groove edge, one joining flush, the other with a V-groove exposed. Installation procedures with both are essentially the same

Metal furring strips, top, are available for attaching ceiling tile to open joists. It's your choice between these and wood furring. Center, locate the first course of tile by snapping chalkline across furring strips. Below, be sure that you follow the instructions on the container when applying adhesive to tiles

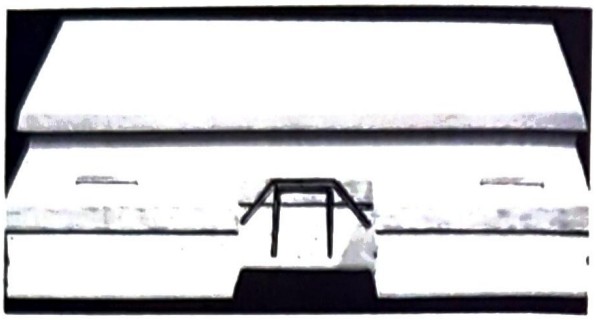
ceilings, continued

Metal furring is also available for attaching to floor joists, as in a basement, or to ceiling joists if exposed in upstairs rooms or in remodeled attics. The metal furring is nailed to the joists and the tiles are stapled in place, using a special gun.

Using adhesive application you can install tile right over old plaster. Of all the methods of installation this is perhaps the simplest and quickest. Of course, you have to be especially careful to locate the starting tile correctly and you should go over the ceiling inch by inch to make sure the plaster is still solidly anchored to the lath. Minor cracks in the plaster won't stop you if the areas adjacent to the crack are anchored. But if there is loose plaster or offsets at cracks of more than $\frac{1}{16}$ in., repairs will be necessary.

Small areas of loose plaster can be knocked off the lath and the opening patched, using patching plaster. Small offsets at cracks can be sanded flush. But if relatively large areas of plaster are loose it may be best to go to furring. Otherwise there is danger of this portion of the ceiling falling unexpectedly into your lap sometime later on. If you decide to go to furring over old plaster it is essential to use nails of sufficient length to pass through both the furring and plaster and enter the joists at least half their length.

When tiling over old plaster the precautions are few but they should be noted closely. Follow instructions on the container for amount and placement of the dabs of cement on the back of each tile. Be sure each tile is pressed into full contact at the joint and that the corners are flush.



Using a recently developed stapling method, you can attach ceiling tile directly to plasterboard. You can borrow or rent the special stapler used

Photo courtesy The Marlite Co.

These ceiling tiles, or blocks, are 16 in. square and come in several colors, are resistant to heat and high humidity. Matching cove is also available